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Original Article

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Antecedents of turnover intentions among anaesthesia nurses: A quantitative, cross-sectional survey study

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ABSTRACT

Background: The intention to leave the profession among nurses often arises from dissatisfaction or a lack of professional fulfillment. The departure of nurse anaesthetists has significant implications for healthcare delivery, as their role in anaesthesia and perioperative care is both specialised and indispensable. The process of replacing nurse anaesthetists is time-intensive, requiring extensive training and adaptation to new working environments.

Methods: A cross-sectional survey was conducted among 194 Greek nurse anaesthetists working in public hospitals in Greece to examine factors influencing turnover intentions. A total of 111 completed questionnaires were collected using a structured tool that assessed demographics, job satisfaction, perceived stress, and intention to leave. The study assessed work-related stress, work-family conflict, psychological empowerment, organisational commitment, work commitment, job satisfaction, and turnover intentions using a structured questionnaire.

Results: A total of 111 anaesthesia nurses participated in the study. The results revealed that high levels of perceived stress and low job satisfaction were significantly associated with increased intention to leave the current position ($p < 0.05$). Additionally, work–family conflict was found to be a strong predictor of turnover intention ($p < 0.05$), particularly among participants with caregiving responsibilities. Statistically significant associations were also observed between intention to leave and variables such as age, years of experience, and type of employment. Nurses with fewer years in the profession and those in temporary contracts were more likely to consider leaving. These findings highlight the multidimensional nature of turnover intention, shaped by both occupational stressors and personal circumstances.Conclusions: In contrast to prevailing theoretical frameworks, nurse anaesthetists' turnover intentions appear to be unaffected by work-related stress and work-family conflict. Instead, psychological empowerment and organisational commitment

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serve as primary determinants of retention. Although job satisfaction does not directly influence nurses' intention to leave the profession, it may contribute to decisions regarding workplace transitions within the healthcare sector.

Key Words: *Turnover intention; organisational commitment; nurse anaesthetists; job satisfaction; work-family conflict*

INTRODUCTION

The term "intention to leave" in the literature refers to an individual's consideration of voluntarily changing their department or workplace [1]. For anaesthesia nurses, this decision is particularly critical, not only for their own professional trajectory but also for the department they serve. Their role within the anaesthesiology ward is pivotal and irreplaceable in ensuring high-quality patient care [2]. Retention in the profession is influenced by multiple factors, including professional fulfillment [3], commitment to the organisation, and overall job satisfaction.

Several additional factors contribute to nurses' turnover intentions, including economic considerations related to salary and employment conditions, workplace conflicts, understaffing, and increasing job demands that may conflict with long-term career stability [4]. Despite the global recognition of nursing shortages and the widespread concern regarding nurses' intentions to leave [5], efforts to enhance job satisfaction alone have not yielded significant improvements in retention [2].

A seminal study by Mobley et al. [6], which examined 203 hospital professionals across various specialties, concluded that an individual's intent to leave is often a precursor to permanent departure. Research has also indicated no significant correlation between age and retention in the nursing profession [7–11]. Furthermore, Mobley, Horner, and Hollingsworth [6] suggested that once a nurse begins contemplating resignation, they actively seek alternative career opportunities. One of the key indicators of turnover intention is dissatisfaction with the work environment [12]. High dissatisfaction levels are often associated with a poor workplace atmosphere, which can lead to professional disengagement and eventual departure [13]. However, research addressing the definitive and long-term departure of nurses from the profession remains limited [14].

According to data from the 2018 U.S. National Sample Survey of Registered Nurses [15], approximately 13.6% of nurse anaesthetists left their positions within a single year, while an additional 37.6% considered leaving but did not resign, bringing the total proportion affected by turnover intent to over 50% [15]. The most frequently cited reason for this trend was "better pay and benefits," surpassing even burnout as a motivating factor. While comparable national data for Greece are lacking, similar concerns have been raised in local healthcare settings. Nurses in Greece face comparatively lower salaries than their European counterparts, compounded by a rising cost of living, which likely contributes to dissatisfaction and attrition. These pressures underscore the importance of investigating the factors influencing anaesthesia nurses' decisions to stay or leave their roles.

Recent literature has also highlighted the complexity of nurses' turnover intentions, distinguishing between intention to leave the current workplace and intention to leave the profession entirely. Decision to leave is not solely determined by job dissatisfaction, but also by lack of recognition, personal strain, and limited professional development opportunities [15]. In addition, there is conceptual differentiation between organisational and professional withdrawal, as some nurses may seek to transfer within the system, while others may consider a full exit from nursing. These two constructs—intention to leave the organisation and intention to leave the profession—are interconnected but distinct, and their separate evaluation provides a deeper understanding of the underlying motivations behind turnover in specialised nursing roles [16].

This study aims to investigate the factors influencing anaesthesia nurses' intentions to leave their profession and how these factors impact their decision-making process. By identifying the primary drivers behind turnover intentions, this research seeks to provide insights into the potential weakening of the nursing sector, particularly in the field of anaesthesiology [17].

Material and Methods

To examine the factors influencing nurse anaesthetists' turnover intentions, the following hypotheses were investigated for their correlation with turnover:

i. Work-related stress and intention to leave.

ii. Work-family conflict and intention to leave.
iii. Organisational commitment and intention to leave.
iv. Work commitment and intention to leave.
v. Psychological empowerment and intention to leave.
vi. Job satisfaction and intention to leave.

Study Design and Data Collection

A cross-sectional survey was conducted among nurse anaesthetists working in 15 Greek hospitals under the jurisdiction of the 3rd and 4th Regional Health Authorities (YPE) in Central Macedonia. Approval was obtained from the respective scientific councils of the YPEs and the hospitals. The survey was distributed between March and May 2022, either in person or by post, with additional copies sent to hospitals that requested them. Out of the 194 questionnaires distributed, 111 were completed and returned.

Demographic and Professional Characteristics

The first section of the questionnaire collected demographic and professional data, including:

- Personal Information: Gender, age, marital status, and educational background.
- Professional Data: Employment status, organisational structure, role within the anaesthesiology department, number of operating rooms, availability of recovery units, presence of a nurse in each operating theater, and total years of experience in both nursing and anaesthesiology.
- Family-related Data: Marital status and its potential impact on work-family balance.

This demographic profiling aimed to assess how experience, specialisation, and personal circumstances influenced turnover intentions.

Survey Instrument

The questionnaire consisted of seven units, including in total 63 items, designed to assess work-related stress, work-family conflict, organisational and work commitment, job satisfaction, psychological empowerment, and turnover intentions (Supplementary Material 1). Responses were coded using various Likert scales to quantify levels of agreement or frequency, allowing for the creation of composite scores for each variable.

The response scales were structured as follows:

- Emotional State Questions: 0–4 (Strongly Disagree to Strongly Agree)
- Family State Questions: 1–7 (Strongly Disagree to Strongly Agree)
- Work State Questions: 0–6 (Never to Very Often)
- Work Environment Questions: 1–5 (Strongly Disagree to Strongly Agree)

Measurement Scales

The following questions related to the investigation of the examined variables were derived from validated bibliographic sources, with responses provided on a Likert scale, to measure key variables:

The «Work-Related Stress and intention to leave « section was developed using the Perceived Stress Scale (PSS) questionnaire [18], and consists of ten items assessing subjective stress perception. A total score ranging from 0–13 indicates low stress levels, 14–26 represents moderate stress perception, and 27–40 reflects high stress levels. For items 4, 5, 7, and 8, reverse scoring was applied, with values adjusted as follows: 0 = 4, 1 = 3, 2 = 2, 3 = 1, and 4 = 0.

The «Work-Family Conflict and intention to leave « section was based on the Work and Family Conflict Scale (WAFCS) questionnaire [19], which comprises ten statements. Each respondent's total score is calculated, with higher scores indicating greater levels of work-family conflict.

The "Work Commitment and intention to leave " section utilised the Utrecht Work Engagement Scale (UWES) [20], a nine-item measure of employee engagement and commitment. The cumulative score of each respondent is used to measure work commitment, where higher scores reflect a stronger commitment to work.

The "Psychological Empowerment and intention to leave " section, measured using a 12-item scale adapted from Spreitzer's Psychological Empowerment Questionnaire [21], assessed the psychological empowerment nurses experience in their work. Higher scores on this variable denote greater psychological empowerment.

The "Organisational Commitment and intention to leave", measured using a 9-item scale [22] that assesses employees' attachment to their organisation section, explored the commitment employees feel toward the hospital in which they work. Responses were summed to create the organisational commitment variable. Due to the wording of question 2, reverse scoring was applied. High cumulative scores on this variable indicate low commitment to the organisation.

The "Job Satisfaction and intention to leave" section, assessed using a validated nine-item scale [23], focused on the level of satisfaction nurses feel within their department. Responses were summed to calculate the total job satisfaction score, with higher scores indicating greater job satisfaction.

For the "Intention to Leave the Organisation" section,

responses were summed to create a total variable score. Due to the wording of question 3, reverse scoring was applied. High scores indicate a greater intention to leave the organisation.

Finally, the "Intention to Leave the Profession" section included a single direct question where nurses were asked to respond honestly regarding their intention to leave the profession.

Statistical Analysis

The questionnaire responses were analysed using Spearman's rank correlation coefficient (ρ) to examine the relationships between selected variables and the intention to leave. This method is suitable for handling multiple factors with a high number of related questions. The following hypotheses were tested: whether work-related stress, job satisfaction, work-family conflict, organisational commitment, psychological empowerment, and work engagement influence nurses' intention to leave their current position or profession.

Spearman's correlation coefficient values range from -1 to 1, where positive values indicate a direct relationship and negative values indicate an inverse relationship. After calculating the correlation coefficient for each variable, hypothesis testing was conducted to determine whether the coefficients were statistically significant ($p < 0.05$).

Survey Instrument

To ensure internal consistency of the measurement instruments used, Cronbach's alpha coefficients were calculated for each questionnaire section. All scales demonstrated acceptable to excellent reliability. Specifically, the Perceived Stress Scale (PSS) showed a Cronbach's alpha of 0.84, indicating good reliability. The Work–Family Conflict Scale (WAFCS) had a reliability coefficient of 0.87. The Utrecht Work Engagement Scale (UWES) yielded an alpha of 0.92, and the Psychological Empowerment Scale showed a value of 0.89. For the Organisational Commitment Scale, Cronbach's alpha was 0.81, while the Job Satisfaction Scale achieved 0.85. Lastly, the Turnover Intention Scale had an internal consistency coefficient of 0.83. These values confirm the reliability of the instruments in assessing the intended psychosocial constructs.

RESULTS

Sample Data Collection

Data for this study were collected using a structured questionnaire distributed to anaesthesia nurses working in 15 Greek hospitals under the jurisdiction of the third and fourth Regional Health Authorities (YPE) in Central Macedonia. Approval was obtained from the relevant scientific councils, and the survey was conducted between March and May 2022. The questionnaires were distributed either in person or by post, with additional copies sent to hospitals upon request. A total of 194 questionnaires were distributed, and 111 completed responses were received and analysed. The questionnaire included sections on demographic and professional characteristics. Participants provided information on gender, age, marital status, and education level. Work-related data were also collected, including employment status, work organisation, position within the anaesthesiology department, number of operating rooms, availability of a recovery unit, and whether a nurse was assigned to each operating room. Additionally, participants reported their total years of experience in both nursing and anaesthesiology. Given the potential impact of work-family balance on turnover intentions, marital status was also recorded.

Demographics and Background Information

The final sample consisted of 16 male nurses (14.4%) and 95 female nurses (85.6%), with an average age of 46.9 years (median 48 years, SD ± 7.8 years). Of the respondents, 68% reported being married, followed by 14% who were single, 10% who were divorced, and 5% who were in a relationship. The lowest percentages were observed among widowed individuals and those in a civil partnership, each accounting for 2% of the sample. Regarding educational background, the majority (89%) of respondents had obtained higher education degrees in nursing, while 11% had secondary education qualifications. Among the higher education graduates, 62% had graduated from Technological Educational Institutes (TEI), 2% from universities (AEI), and 25% held postgraduate degrees, emphasising the importance of further professional development in nursing. In terms of employment status, 89.2% of the participants were permanent public sector employees, while the remaining 10.8% were on fixed-term contracts. The nursing staff primarily consisted of operating room nurses (84.7%), with supervisors and deputy supervisors comprising 15.3%. Table 1 presents the demographic characteristics of the sample.

Work Experience

The average work experience in nursing was 22.5 years (median 23 years), with a standard deviation of 8.67 years. The least experienced nurse had one year of service, while the most experienced had 38 years, resulting in a range of 37 years. In the anaesthesiology department, work experience ranged from a minimum of one year to a

TABLE 1. Demographic characteristics of the sample (N = 111).

Variable	Category	N (%)
Gender	Male	16 (14.4%)
	Female	95 (85.6%)
Age (years)	Mean (SD)	46.9 (±7.8)
	Median	48
Marital Status	Single	14%
	Married	68%
	Divorced	10%
	In a relationship	5%
	Widowed	2%
	Civil partnership	2%
Education	Secondary education	11%
	TEI	62%
	University (AEI)	2%
	Postgraduate degree	25%
Employment Status	Permanent	89.2%
	Temporary	10.8%
Job Position	Operating Room Nurse	84.7%
	Supervisor/Deputy Supervisor	15.3%
Work Experience (Years)	Mean (SD)	22.5 (±8.7)
	Range	1 – 38
Anaesthesiology Experience	Mean (SD)	8.76 (±7.65)
	Range	1 – 34

maximum of 34 years, with a mean of 8.76 years (median 6 years) and a standard deviation of 7.65 years, leading to a range of 33 years.

Operating Room Statistics, Workplace Resources and Staffing

The average number of operating rooms reported was 7.27 (median 5), with a standard deviation of 4.95. The minimum number of operating rooms was one, and the maximum was 21, resulting in a range of 20. Additionally, 84.7% of the respondents indicated that their hospital included a recovery area on-site, while 79.3% stated that there was one nurse assigned to each operating room. Additional workplace-related information, including recovery unit availability and nurse allocation per operating room, is summarised in Table 2.

TABLE 2. Workplace and hospital characteristics.

Variable	Category/Statistic
Number of Operating Rooms	Mean (SD) = 7.27 (±4.95)
	Median = 5; Range = 1–21
Recovery Unit Available	Yes = 84.7%
One Nurse per Operating Room	Yes = 79.3%

Correlation analysis of key variables

The descriptive statistics for the aggregated variables are presented in Table 1. More particularly:

- Work-Related Stress: There was no significant correlation between work-related stress and the intention to leave ($\rho = 0.106$, $p = 0.271$).
- Work-Family Conflict: Similarly, no significant relationship was found between work-family conflict and the intention to leave ($\rho = 0.139$, $p = 0.150$).
- Job Satisfaction: No significant correlation was observed between job satisfaction and the intention to leave ($\rho = 0.129$, $p = 0.176$).
- Work Engagement: A moderate negative correlation was found between work engagement and the intention to leave ($\rho = -0.384$, $p < 0.001$).
- Psychological Empowerment: Psychological empowerment showed a strong negative correlation with the intention to leave ($\rho = -0.511$, $p < 0.001$).
- Organisational Commitment: A strong negative correlation was observed between organisational commitment and the intention to leave ($\rho = -0.479$, $p < 0.001$).

Significant variables and their influence

Only work engagement ($p < 0.001$), psychological empowerment ($p < 0.001$), and organisational commitment ($p < 0.001$) were significantly correlated with the intention to leave. These variables demonstrated a moderate to strong negative relationship, indicating that higher levels of these factors were associated with a reduced likelihood of leaving. Conversely, work-related stress, work-family conflict, and job satisfaction were not significantly associated with the intention to leave ($p > 0.05$). Detailed results are presented in Table 3 and Figure 1. In addition, Table 4 presents the significant and non-significant variables alongside their correlation coefficients and p-values.

Additional Findings

The mean score for intention to leave the profession was 2.05 (median: 2, SD: 1.29), highlighting low overall turnover intentions among the surveyed nurses.

TABLE 3. Descriptive statistics for the aggregated variables.

Variable	Mean	SD	Min	Max
Work-Related Stress	22.3	3.42	15	31
Work-Family Conflict	34.9	10.1	10	55
Work Engagement	30.6	11.4	2	54
Psychological Empowerment	59.7	10.3	35	84
Organisational Commitment	11.8	1.27	9	15
Job Satisfaction	8.98	1.70	3	15
Intention to Leave	7.95	2.68	3	15

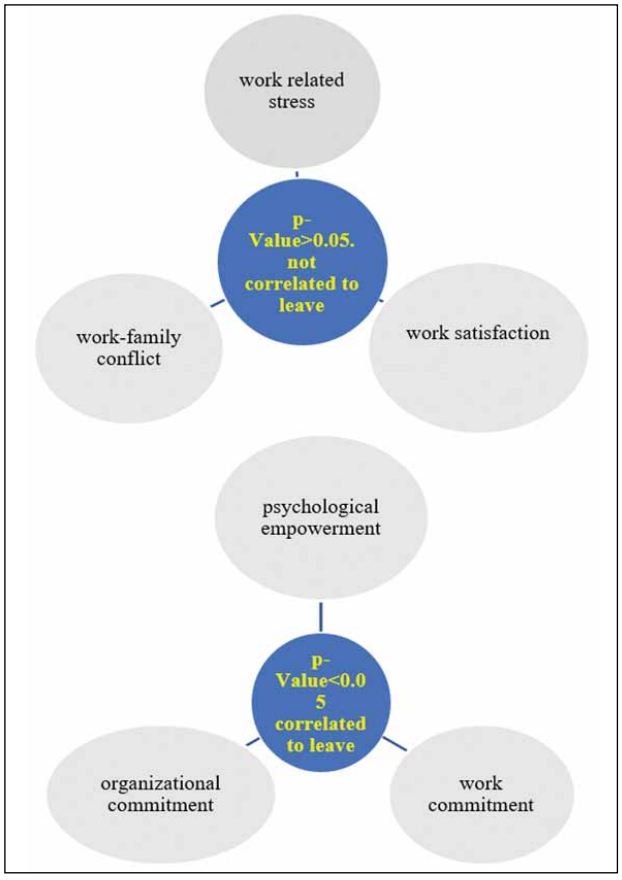

FIGURE 1. Correlation and grouping of variables.

DISCUSSION

The present study explored factors influencing turnover intention among anaesthesia nurses in Greece, focusing on work-related stress, work–family conflict, psychological empowerment, organisational commitment, work engagement, and job satisfaction. Contrary to widespread theoretical assumptions, the findings revealed that neither work-related stress nor work–family conflict significantly influenced turnover intentions in our sample. This is noteworthy, as previous research has consistently identified stress and work–family imbalance as significant predictors of turnover in nursing populations [24,25]. A plausible explanation for this divergence is the high level of professional resilience and adaptation exhibited by anaesthesia nurses, who may have developed coping mechanisms due to the critical nature of their role [26].

Nurses' intention to leave does not appear to be significantly influenced by work-related stress. This finding contradicts the initial hypothesis, as stress is often cited as a major factor influencing turnover intentions in other professions. It is possible that nurse anaesthetists have adapted to the unique and intense stressors of their roles, which mitigates its impact on their career decisions.

Similarly, the findings suggest that work-family conflict does not significantly affect nurse anaesthetists' intention to leave. This result challenges existing theories, which posit that neglecting family needs or encountering challenging family circumstances increases turnover intentions. A plausible explanation is that the specialised nature of the profession and the expertise of nurse anaesthetists foster a sense of duty that families may come to understand and tolerate.

Psychological empowerment emerged as a robust predictor of retention. Nurses who reported feeling autonomous, competent, and impactful in their roles were significantly less likely to consider leaving [27,28]. This aligns with findings by Fragkos et al. [29] and Ibrahem et al. [30], who emphasised that psychological empowerment fosters professional engagement and reduces turnover

TABLE 4. Significant variables and their influence on turnover intention.

Variable	Spearman's ρ	p-value	Interpretation
Work Engagement	–0.384	< 0.001	Moderate negative correlation (significant)
Psychological Empowerment	–0.511	< 0.001	Strong negative correlation (significant)
Organistional Commitment	–0.479	< 0.001	Strong negative correlation (significant)
Work-Related Stress	0.106	0.271	No significant correlation
Work-Family Conflict	0.139	0.150	No significant correlation
Job Satisfaction	0.129	0.176	No significant correlation

intent. Empowered nurses often perceive greater control over their work environment, which enhances job satisfaction and organisational loyalty [31].

Similarly, organisational commitment demonstrated a strong negative association with turnover intention. This supports Meyer and Allen's [32] three-component model of commitment, wherein affective commitment—emotional attachment to the organisation—is inversely related to turnover intent. Nurses with a strong sense of belonging and alignment with organisational values are more likely to remain in their positions, consistent with findings from Park and Kim [33] in healthcare settings. The above are consistent with theories by Reichheld and Team [34] and Kyle LaMalfa [35], the results indicate that a greater sense of belonging within an organisation reduces nurses' intention to leave. Conversely, a lack of organisational commitment serves as a strong predictor of turnover [27].

The current findings align with previous research suggesting that intention to leave the organisation does not necessarily equate to intention to abandon the profession [36]. Literature supports that some nurses contemplate internal mobility due to unfavorable conditions in their current workplace, while maintaining a commitment to their professional identity [37]. This distinction is crucial for developing retention strategies, as it highlights the need for targeted interventions at both the organisational and systemic levels. Understanding whether nurses are seeking change within their field or contemplating complete professional exit allows for mor

Interestingly, job satisfaction did not exhibit a significant effect on turnover intentions in our study. This contrasts with seminal work by Mobley et al. [6], who identified job dissatisfaction as a primary driver of employee turnover. One potential reason for this discrepancy could be that job satisfaction, while important, does not fully capture the complexities of professional identity and commitment in highly specialised roles such as anaesthesia nursing. Recent literature suggests that intrinsic motivators, such as perceived professional growth and recognition, might weigh more heavily than general job satisfaction in influencing turnover decisions [38].

In conclusion, this study advances our understanding of turnover intentions among anaesthesia nurses by highlighting the protective roles of psychological empowerment, organisational commitment, and work engagement. Interventions targeting these factors could play a pivotal role in retaining skilled anaesthesia nurses, ultimately safeguarding the quality of patient care in surgical settings.

Practical implications

The role of a nurse anaesthetist is demanding and specialised, encompassing responsibilities such as managing emergencies, administering anaesthesia, and interpreting patients' vital signs. The stress inherent in this role is intensified by frequent technological advancements, staff shortages, and the perception by hospital administrations that anaesthesiology is an "easier" department. These challenges, compounded by minimal recognition, insufficient training, and outdated working conditions, contribute to turnover intentions.

To address these issues, several measures can be implemented. Continuous professional development, recruitment of younger staff, and incentives such as participation in conferences and educational programs are critical. Establishing anaesthesia nursing as a formal specialty in Greece, accompanied by structured training and certification, could enhance the profession's prestige and improve retention rates. Flexible working hours and childcare support could also alleviate work-life conflicts, enabling nurse anaesthetists to focus on their demanding roles.

Limitations

This study is limited by its relatively small sample size, which may not adequately capture the diverse experiences of anaesthesiology nurses and, while adequate for exploratory analysis, limits generalizability. Additionally, selection bias may have influenced the results, as dissatisfied nurses may have been more inclined to respond. Logistical challenges, including delays in questionnaire distribution and geographical barriers, further constrained the study.

Furthermore, while the findings highlight important work-related and psychosocial factors influencing turnover intention, the economic aspect was not directly assessed in our questionnaire. Nevertheless, financial stress due to low salaries and high living expenses is likely to affect job satisfaction and long-term career decisions. Economic factors, such as salary dissatisfaction—a well-documented driver of nurse turnover [39]-were not explicitly assessed in this study but likely play a role. This omission represents a noteworthy limitation and an area for future research. Furthermore, the study sample had a high average length of work experience (22.5 years), which may reflect a population less inclined to change professions. Finally, the focus on anaesthesia nurses, while relevant to the scope of the study, excludes other nursing specialties that may face different stressors, such as more frequent or intense shift work. Future studies should aim to include a wider range of departments to examine broader patterns of work-related stress and turnover intent across nursing populations. In

addition, including younger nurses in future studies would likely yield a broader and more dynamic range of perspectives, while utilisation of electronic distribution methods could yield a larger and more representative sample.

CONCLUSION

Despite these limitations, this study provides valuable insights into the factors influencing nurse anaesthetists' intention to leave their roles. Expanding the scope of future research to include more anaesthesiology departments across Greece could offer a more comprehensive understanding of these determinants. Such efforts will guide the development of targeted strategies to address turnover intentions and improve workforce stability in this critical field.

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Supplemental Material

SUPPLEMENTAL MATERIAL 1: DETAILED SURVEY INSTRUMENT AND MEASUREMENT SCALES

"Work-related stress" scale. Higher total scores are indicative of greater perceived stress

In the last month, how often have you been upset about something that came up unexpectedly?	0	1	2	3	4
In the last month, how often did you feel like you couldn't control the important things in your life?	0	1	2	3	4
In the last month, how often have you felt irritated and stressed?	0	1	2	3	4
In the last month, how often have you felt confident that you can manage your personal problems?	0	1	2	3	4
In the last month how often have you felt that things are going the way you want them to?	0	1	2	3	4
In the last month, how often did you feel that you could not meet your obligations?	0	1	2	3	4
In the last month how often have you been able to control your irritation?	0	1	2	3	4
In the last month how often have you felt in control of everything?	0	1	2	3	4
In the last month how often have you gotten angry about things you couldn't control?	0	1	2	3	4
In the last month how often did you feel that the difficulties were so many, that you could not control them?	0	1	2	3	4

0=never 1=almost never 2=sometimes 3= fairly often 4=very often

"Work-family conflict" scale. High scores indicate high levels of work-family conflict

My job prevents me from spending sufficient quality time with my family	1	2	3	4	5	6	7
At the end of the day there is not enough time to do the things I would like at home (eg various sports and social activities)	1	2	3	4	5	6	7
My family misses' opportunities due to my work obligations	1	2	3	4	5	6	7
My job has a negative impact on my family life	1	2	3	4	5	6	7
My job makes me nervous and irritable at home	1	2	3	4	5	6	7
My performance at work lags due to my family obligations	1	2	3	4	5	6	7
Family worries and responsibilities often distract me in my work	1	2	3	4	5	6	7
If I didn't have a family, I would be better at my job	1	2	3	4	5	6	7
My family has a negative impact on my daily work obligations	1	2	3	4	5	6	7
It is difficult for me to concentrate on work because I am exhausted by family responsibilities	1	2	3	4	5	6	7

1=totally disagree 2=very much disagree 3=disagree 4= neither agree nor disagree 5=I agree 6=I agree very much 7=I totally disagree

"Work commitment" section. The statements are about how you experience your work and how you feel about it

In my work I feel overwhelmed with energy	0	1	2	3	4	5	6
I feel full of vitality and strength when I work	0	1	2	3	4	5	6
I'm excited about my work	0	1	2	3	4	5	6
My work inspires me	0	1	2	3	4	5	6
When I get up in the morning, I am in the mood to go to work	0	1	2	3	4	5	6
I feel happy when I work intensively	0	1	2	3	4	5	6
I feel proud of the work I do	0	1	2	3	4	5	6
I am completely absorbed in my work	0	1	2	3	4	5	6
My work fascinates me	0	1	2	3	4	5	6

0=never 1=almost never 2=occasionally 3=regularly 4=often 5=very often 6=always

"Psychological empowerment" Section

My job is very important to me	1	2	3	4	5	6	7
My job duties are of particular importance to me	1	2	3	4	5	6	7
My job means a lot to me	1	2	3	4	5	6	7
I trust my abilities to do my job	1	2	3	4	5	6	7
I am confident in the abilities I have to perform my work duties	1	2	3	4	5	6	7
I have specialised skills for the demands of my job.	1	2	3	4	5	6	7
I have considerable autonomy in determining how I work	1	2	3	4	5	6	7
I Can decide for myself how to do my job	1	2	3	4	5	6	7
I have significant margins of independence and freedom in how I will do my job	1	2	3	4	5	6	7
My influence is great on what happens in my department	1	2	3	4	5	6	7
I have a great deal of control over what happens in my department	1	2	3	4	5	6	7
I have a significant influence over what happens in my department	1	2	3	4	5	6	7

1=totally disagree 2=very much disagree 3=disagree 4=neither agree nor disagree 5=agree 6very much agree 7=totally agree

"Organisational engagement"

Overall, I am satisfied with my work	1	2	3	4	5
Overall, I like my job	1	2	3	4	5
Συνολικά, μου αρέσει να εργάζομαι εδώ	1	2	3	4	5
I don't feel "emotionally attached" to the hospital where I work	1	2	3	4	5
The hospital where I work is of great importance to me	1	2	3	4	5
I don't feel like I belong to the hospital where I work	1	2	3	4	5
I often think about leaving the hospital where I work	1	2	3	4	5
It is very likely that I will look for a new job next year	1	2	3	4	5
If I could choose again, I would choose to work for the hospital where I work	1	2	3	4	5

1=totally disagree 2=disagree 3=neither agreenor disagree 4=agree 5=totally disagree

Finally, there was a question the nurses had to answer with sincerity about their intention to leave the profession

How often in the past year have you thought about quitting nursing and starting a completely different job?	1	2	3	4	5

1=never 2= A few times 3= A few times a month 4= A few times a week 5=every day

Review

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Morbidity and Mortality of Major Surgical Interventions in the Third Age

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ABSTRACT

As the global population ages, the incidence of major surgical interventions in elderly patients—those aged 70 years and older—has increased significantly. By 2050, the number of people aged 60 and above is expected to reach 2.1 billion, necessitating a deeper understanding of the unique challenges faced by this demographic in surgical contexts. This study explores the morbidity and mortality associated with major surgeries in the elderly, emphasizing the impact of comorbidities, reduced physiological resilience, and the importance of preoperative and postoperative care. A comprehensive review of existing literature was conducted, focusing on perioperative morbidity, mortality rates, and factors such as cardiovascular, pulmonary, and renal function. The findings underscore the necessity of a multidisciplinary approach in managing surgical patients in this age group, highlighting the role of frailty as a more accurate predictor of surgical outcomes than chronological age. Despite advances in surgical techniques and anesthetic management, the elderly remain at higher risk of postoperative complications and mortality. The study advocates for individualised care strategies and improved preoperative assessment tools to optimize surgical outcomes and reduce the burden on healthcare systems.

Key Words: *Morbidity and mortality; third age; major abdominal procedures*

INTRODUCTION

Among the questions of concern in the third millennium are demographic shifts, particularly the increase in the elderly population, elderly being those aged seventy years and over. By 2050, the global population aged 60 years and older is expected to reach nearly 2.1 billion. In treating the elderly patient, apart from the pathology and the need for a solution to current complaints, the general condition of the patient is also taken into account [1]. Geriatric care is critical, as advanced age often requires more healthcare services, including major surgery. Elderly patients undergoing major surgery face unique challenges and increased risks of morbidity and mortality [2].

Elderly patients frequently suffer from multiple comorbidities such as cardiovascular disease, diabetes, respiratory problems, and renal failure, all of which can impact surgical outcomes. Reduced physiological resilience and decreased functionality of body systems further increase the risk of complications during and after surgery. This highlights the importance of careful preoperative assessment, optimisation of preoperative health, and intensive postoperative care [3].

Investigating morbidity and mortality in elderly pa-

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tients undergoing major surgery is crucial for understanding risks and developing strategies to reduce them. Comparing morbidity and mortality rates between elderly patients, geriatric patients, and the general adult population, as well as between planned and emergency interventions, can reveal critical differences that affect outcomes [4].

This study focuses on analyzing these parameters to improve the management of elderly patients and enhance surgical results. The findings can help develop best practices and implement individualised strategies to reduce morbidity and mortality, thereby improving the quality of life for elderly patients.

MATERIALS AND METHODS

To analyse perioperative morbidity and mortality in elderly patients, we conducted a literature review using databases such as PubMed, Scopus, and Google Scholar. Keywords included "morbidity," "mortality," "elderly patients,""surgery,""preoperative evaluation," and "postoperative care." Emphasis was placed on publications providing data on parameters influencing surgical outcomes in the elderly, such as cardiovascular status, pulmonary function, renal function, and nutritional status.

A total of 83 studies were identified through database searches (PubMed, Scopus, Google Scholar). After title and abstract screening, 56 were assessed for eligibility. Of these, 42 met inclusion criteria and were included in the final review. Studies were excluded due to incomplete data, lack of relevance to elderly populations, or absence of mortality/morbidity outcomes.

RESULTS

The review focused on elderly patients aged 65 years and over, with particular emphasis on those aged 80 years and older and included comparisons with the general adult population. Parameters examined included perioperative morbidity, 30- and 90-day mortality, comorbidities, functional and nutritional status, and preoperative and postoperative care strategies. The use of scoring systems, such as the ASA scale, to predict risks and assess patient conditions was also considered.

Among the accepted studies, 65% focused on elective procedures, while 35% addressed emergency interventions. The 30-day postoperative mortality ranged from 2% to 19% for elective surgeries and 12% to 33% for emergency procedures. Frailty was evaluated in 70% of the studies, with the most frequently used tools being the Frailty Index and the Clinical Frailty Scale. Nutritional status, comorbidities (especially cardiovascular and renal), and age ≥80 were consistently linked with higher complications

DiscussionAs the population ages, the rate of surgery among the elderly increases. Major surgery and related interventions, such as blood transfusion, place a heavy burden on patients. Complications after surgery can lead to higher mortality rates in older patients up to one month later. There has been a noticeable increase in surgical interventions for older patients in recent years, including a surge in more complex operations that demand careful consideration [5]. While surgery has substantially improved with advanced understanding of disease and sophisticated assessments, it also presents significant challenges in managing elderly patients, who often require special attention. Patient selection for surgery now entails an in-depth examination of frailty, utilizing innovative scoring systems that have revolutionised the field, and actively challenging preconceived ideas and prejudices to ensure optimal outcomes and personalised care for the aging population [6].

Elderly patients nowadays undergo major surgery more frequently compared with the past. There has been a significant increase in the NHS England percentage of adults aged 60 and over seen on a per annum basis. Specifically, 2.5 million people over the age of 75 underwent surgery between 2014 and2015, up from 1.5 million between 2006 and2007, with 30% of those being over 85 years of age. Over the same timescales, there has been a slight decline in the percentage of patients seen aged under 40 and aged 40 to 60. A similar pattern of increased aging is occurring in hospitals in Australia. There, women over 85 now account for the majority of emergency surgical admissions [7].

Advanced age increases the risk of mortality and morbidity after surgery, but frailty, a decline in multiple physiological systems, is a better predictor than chronological age. There are a number of useful measuring tools designed to detect the presence of frailty in the older surgical patient. These can be either patient reported (using questionnaires) or specific practical tests. The frailty phenotype model includes features such as sluggishness, weakness, exhaustion, weight loss, and low physical activity. The cumulative deficit (FI) model assesses frailty through the accumulation of deficits, with higher scores indicating greater frailty [8]. Even that there is no standardised method of measuring frailty, and with over 20 different instruments identified, a novel classification by Rockwood, a Canadian geriatrician, has gained prominence to the extent of the many criteria, like disease or disability burdens or leisure activities, designed to measure frailty among the senior citizens. The advantage of this classification stems in its ease of use while providing a very

robust model with a robust specificity and sensitivity to detect frail older adults [9].

In a population increasingly characterised as frail, but difficult to identify, measure, or predict - surgical risk assessment has undergone a radical shift in recent years. Traditionally, assessment was based on generalised markers of ill-health, severity of comorbid conditions, and overall negative physiological decline, within the safe bubble of a fairly theoretical assumption that said patients would be likely to return to pre-illness level of function after major surgical intervention; today, the focus is much more on identifying the impact of a multiplicity of functional and physical losses predicting a decreased, burdened ability to regain preoperative health status [10, 11].

The very elderly (age ≥ 80 years) frequently experience frailty influenced by medical comorbidities, nutritional status, mental health, social support, and cognitive function.These individuals are at a heightened risk of negative outcomes from physiological stress and illness [8]. Morbidity and mortality of major surgical intervention in the growing third age population remain a present challenge, although anaesthetic management is clearly improved. Emergency surgery is particularly a grey area, and older patients are more likely to present on an emergency basis. Recent figures suggest that once admitted to hospital for acute illness, the third age patients are much more likely to have surgery. The third age patient is expected to preponderate in all categories of surgery in the near future. Advances in anaesthetic management, preoperative evaluation, and management do have an important effect on patient outcome, improvement in the overall outcome, and cost efficiency of surgery in a health system. However, older age exposes patients to greater risks of postoperative complications and mortality compared with younger patients experiencing the same operation [12, 13].

Preoperative assessment in the older population is complex due to the heterogeneity of coexisting chronic diseases. Management guidelines are difficult to develop and generalisation of evaluation results is challenging. Anesthesia risks in those over 80 vary based on surgery type, urgency, age, and comorbidity. In emergency cases, surgical intervention is more complicated and riskier due to deteriorated physiological function. Balancing expectations and poor outcomes in older patients is a challenge [14]. More research is needed to improve outcomes and cost efficiency in surgical management. Assessment tools such as the ASA Physical Status Classification Systemhave proven useful in predicting complications and mortality in elderly patients. Age and comorbidities should not be the only factors for surgical referral; tools like the ASA classification can help surgeons inform patients and families about the risks prior to procedures [15].

Gastrointestinal cancer is becoming increasingly prevalent among the elderly, driven by an ageing population and the cumulative genetic damage that occurs over time. The incidence of this cancer for those over 65 is rising swiftly. The U.S. population aged 65 and older is expected to grow from 35 million to 70 million by 2030. The median age of death for pancreatic, stomach, and colorectal cancers falls between 71 and 77 years. Surgical resection remains the sole treatment option for localised gastrointestinal cancers. Almost 30% of all operations performed for colon and rectal cancer are in patients over seventy, and postoperative recovery is influenced by various physiological changes that occur with ageing, such as cognitive, functional, and communication limitations [16].

Among cancers, lung cancer was the most common cause of death in the elderly in 2016, with a rate of 192.4 per 100,000 elderly residents. Prostate, colon, and breast cancers had lower death rates. Additionally, in some EU Member States, death rates from cerebrovascular diseases were higher than from ischaemic heart diseases [17].

While postoperative complications are more common in older adults, age should not be the sole factor in determining treatment, as individuals of the same age can differ significantly in their physical and mental health. Despite older patients having similar survival rates to younger patients following oncological surgeries, geriatric patients often do not receive oncology care due to age-related biases.

The care of elderly cancer patients must be a collaborative product of a multidisciplinary team that includes surgeons, oncologists, geriatricians, and psychologists. Differentiation of cancer types is avoided to provide a general overview. Factors such as functional status, cognition, depression, nutritional status, mobility and ASA score are associated with adverse postoperative outcomes regardless of age. Screening tools can aid in preoperative evaluation to mitigate complications, although their use has not been widely adopted [15].

Modifiable risk factors such as nutritional status and physical activity must be prepared and improved before surgery. Preoperative rehabilitation can reduce postoperative morbidity and improve patients' functional status. However, there is controversy over whether these preparations delay necessary surgery [18].

It is important to recognise the influence of different health systems, cultures, and economies on cancer treatment in the elderly. Health systems' incentives influence surgical judgment. In public health systems, performance is related to financial gain, while in private systems, performance is based on saving money. Surgeons must

consider these influences when making decisions about treating patients [19].

In 2016, circulatory diseases were the primary cause of death among the elderly in the EU, whereas cancer was the main cause of death for individuals under 65. Specifically, around 40.3% of deaths among the elderly were attributed to circulatory diseases, 23.4% to cancer, and 8.1% to respiratory diseases. Older women had higher rates of death from circulatory disease (43.3%) compared to men (36.8%), while older men had higher rates of death from cancer (28.1% vs. 19.3%) and respiratory diseases (9.2% vs. 7.2%) [20]. In contrast, for those under 65, cancer was the leading cause of death, with rates of 47.8% for women and 32.1% for men. Deaths from respiratory diseases accounted for 4.4% of all deaths in people under 65, while circulatory diseases accounted for 24.1% of deaths in men and 16.6% in women [17]. Sata show that the standardised death rates for ischaemic heart disease, cerebrovascular disease, respiratory disease, and lung disease were higher among older adults in 2016. Specifically, the standardised death rate for ischaemic heart disease was 538.2 deaths per 100,000 elderly residents, while for cerebrovascular diseases it was 384.5 per 100,000 elderly residents [21].

In the setting of the geriatric patient, it is particularly important to guarantee the benefits, requiring careful comprehensive management. Alteration of the biological equilibrium of the elderly is clearly evident in clinical and functional characteristics that distinguish them from other patients who are candidates for cardiac surgery and general surgery. Cardiological evaluation is essential and represents the keystone from which to develop the diagnostic therapeutic plan in elderly patients. Geriatric evaluation can provide information on the degree of disability, but can also give rise to general recommendations of disease-oriented strategies and treatment. From the data shown by different surgical disciplines, it strengthens the concept of the necessity of a "multidisciplinary" approach to consider the elderly patient and to face the complex problems posed by surgical therapy in the third age. In this setting, the multidisciplinary approach should not only be a collection of different professionals according to specific professional capabilities, operating unit by operating unit, but should aim at the concept of a shared action in which each involved member tries, starting from their own specific competences, to contribute to the global goals of personalised geriatric intervention [22]. There is a lack of comprehensive data on the surgical care of the elderly. Only a limited number of studies have detailed the differences in care between older and younger patients [21].

Comparing postoperative factors, elderly patients had fewer aggressive interventions and lower resource utilisation despite having more comorbidities and an increased incidence of trauma. In contrast, the middle age group (65-79) had higher rates of resource use, such as intensive care and length of hospital stay, despite a lower rate of trauma [20]. Few studies have evaluated the use of postoperative intensive care for the elderly. One US database did not include ICU admission, while another study showed reduced rates of ICU admission for patients 80+ years of age. Factors such as the presence of malignancy and its staging may influence the decision to admit to the ICU [18].

The identification of postoperative complications was less frequent in the older age group even though they had multiple comorbidities. This could be attributed to a tendency for less rigorous monitoring and intervention in elderly patients. Although guidelines and scoring systems have been established to determine the appropriateness of interventions, their implementation remains limited [17].

A recent report from the Royal College of Surgeons of England highlighted the challenges in emergency surgery, reporting that the mortality in people over 80 was over 25%, with wide variations between hospitals. Elderly individuals over the age of 80 now represent a substantial portion of hospital admissions, and their numbers are projected to double by 2030 [23].The study aimed to determine mortality in patients over 80 years of age undergoing emergency surgery at a large UK teaching hospital. Of 4,069 admissions, 521 patients were over 80 years of age, with a 30-day mortality of 19%. Factors such as poor preoperative status (ASA > III) and cardiac comorbidities contributed to postoperative complications [24]. Hessman et al. emphasised that age should not preclude surgery, as ASA score is a better predictor of mortality. The ASA score, which assesses physical health in five categories, shows that higher categories are associated with an increased risk of complications. Similarly, Abbas and Booth reported a mortality of 29% after emergency abdominal surgery, but only 7.5% after elective procedures [25,26].

Studies in the United Kingdom, such as that of Saunders et al., showed a mortality of 24.4% in patients over 80 years of age after emergency laparotomy. Byrne et al. suggested looking at mortality at 90 days as complications may occur beyond the 30-day window. A review of 17 studies showed a 30-day mortality of 0–13% after elective colorectal resection, highlighting the need for long-term follow-up of mortality in elderly patients [27,28].

CONCLUSION

This review underscores the complexity of surgical care in elderly populations, where factors like frailty, comorbidities, and emergency presentation heavily influence outcomes. Frailty—more than chronological age—has

emerged as the most reliable predictor of morbidity and mortality. Various frailty scoring systems, including the Clinical Frailty Scale and the Rockwood Frailty Index, are increasingly being integrated into perioperative risk assessments.

Minimally invasive surgical (MIS) approaches have shown promising results in elderly patients, with studies indicating reduced postoperative complications, shorter hospital stays, and lower mortality when compared to open procedures. However, patient selection remains critical, especially in the context of complex or emergent cases.

Prehabilitation protocols, including aerobic training, nutritional optimisation, and mental health support, have been shown to enhance functional status and reduce complications. However, standardised implementation is still lacking, and further research is needed to evaluate long-term benefits.

Emergency surgeries remain associated with the highest mortality rates, particularly in patients over 80 with multiple comorbidities. Delayed interventions due to poor initial optimisation contribute to the disparity between elective and urgent procedures. There is a growing consensus that risk calculators incorporating functional status and nutritional metrics better predict outcomes than traditional tools like ASA scores alone.

The findings *of this review advocate for multidisciplinary preoperative evaluation, early identification of frailty, and tailored perioperative plans to reduce the burden of postoperative complications in the ageing surgical population.*

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Brief Communication

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Well-Being Versus Burnout: Does a surgeon's quality of life impact patient outcomes?

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ABSTRACT

Surgeons often encounter intense physical and cognitive demands, heavy workloads, critical life-or-death decisions, and emotional distress arising from patient outcomes. All these factors contribute to a gradual decline in the well-being and quality of life for practitioners and, simultaneously, to increasing rates of depression and burnout among surgeons, resulting in severe ramifications for patient care.

Considering the positive effects of surgeons' well-being on providing the best care for patients, the concept of work-life integration is becoming a targeted goal for today's surgeons.

The basic components of a well-being state—physical and mental health, work-life integration, professional support, and a supportive institutional environment—affect patient care and ultimately determine surgeons' quality of life. In this regard, individuals, societies, and organisations should implement strategies and programs that foster well-being.

Key Words: *Well-being; quality of life; resilience; burnout*

INTRODUCTION - DEFINITIONS

One of our priorities in daily surgical practice is to ensure our patients have a good quality of life by providing high-quality care. However, to deliver the best care for our patients, we must experience a state of well-being.

Well-being is a multifaceted mental state that relies on various emotional, occupational, physical, intellectual, financial, social, spiritual, and environmental factors. The five pillars of a surgeon's well-being include physical and mental health, work-life balance, professional support, and a nurturing institutional environment. All these components of well-being, either directly or indirectly, influence patient care and ultimately shape the quality of life for surgeons [1].

The World Health Organization defines **quality of life** (QOL) as "an individual's perception of his/her position in life, in the context of the culture and value systems in which he/she lives, following his/her goals, expectations, standards, and concerns. Standard indicators of the quality of life include wealth, employment, the environment, physical and mental health, education, recreation, social belonging, religious beliefs, safety, security, and freedom [2].

"Well-being for surgeons" is a really important and growing topic. Surgeons often deal with intense physical, emotional, and cognitive demands, life-or-death decisions, and emotional weight from patient outcomes. Over time, all this can lead to stress, burnout,and eventually depression, which not only affects them personally but can also impact patient care [3].

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Burnout is a syndrome encompassing three domains: depersonalisation, emotional exhaustion, and a sense of low personal accomplishment. The World Health Organization (WHO) defines **burnou**t as a syndrome resulting from chronic workplace stress that has not been successfully managed. It is characterised by three dimensions: a) feelings of energy depletion or exhaustion; b) increased mental distance from the job, or feelings of negativism related to that particular job, and c) reduced professional efficacy [4]. A meta-analysis including 16 cross-sectional studies and a total of 3581 subjects concluded that about 3% of surgeons suffer from an extreme form of burnout (burnout syndrome) and up to 34% of surgeons may experience burnout characterised by high levels in one of the three domains (emotional exhaustion, depersonalisation, and reduced personal accomplishment) [5]. Likewise, the correlation between burnout and medical errors is strongly related, depending on the surgeon's degree of burnout and mental quality of life [6].

Authenticity as an Independent Factor of Quality of Life

There is convincing evidence that authenticity is an important qualitative distinctive factor contributing to a good QOL for a surgeon, and it potentially protects against burnout and depression [7]. Authenticity is the honest and true expression of our core self in all situations, relationships, and roles. It requires knowing ourselves, aligning with our true beliefs, values, emotions, thoughts, and actions, and expressing ourselves outwardly, sincerely, and consistently [7,8]. Being authentic has been shown to promote positive mental health and psychological outcomes as well as multiple positive traits, including compassion, sense of purpose, and resilience. Authentic individuals are also generally better at coping with stress and adversity [7-10].

Hence, surgeons who behave authentically and live according to their values are more likely to find a sense of purpose and fulfillment, reducing the risk of burnout. Similarly, authentically engaging with one's work often leads to increased job satisfaction [11]. This increased satisfaction helps surgeons in all the stages of their training and career development to feel more secure in their professional role by establishing solid identities, developing confidence in their skills, and achieving a level of career stability.

As a beneficial consequence, the authentic surgeons manage to integrate their personal and professional lives in a more rewarding way, achieving a better work-life balance that contributes to overall well-being [12].

Authenticity is directly correlated with the professional rank, with senior faculty demonstrating the highest levels. On the other side, inauthenticity is associated with a decrease in professional rank, with residents reporting the highest level of inauthenticity. Another cause of inauthenticity among junior faculty comes from their effort to establish themselves within the institution, meet tenure requirements, and build a reputation. This emphasis on career advancement could lead to prioritising conformity by suppressing their authentic selves in order to align with institutional expectations, norms, or career advancement goals. [13].

As the harmful consequences of inauthenticity eventually lead to burnout and depression, it becomes apparent that acknowledging and fostering authenticity could serve as a powerful intervention strategy to mitigate burnout and depression among surgeons.

Several interventions in one's surgical practice promote authenticity. A working environment that supports open communication, resilience, mindfulness training, and introspection includes some serious strategies for cultivating and establishing such an authentic behavior [14].

Mental Health within the Surgical Field

Despite efforts to improve patient safety, medical errors by physicians remain a common cause of morbidity and mortality. Major medical errors reported by surgeons are strongly related to a surgeon's degree of burnout and their mental QOL [15].

Physicians with suboptimal well-being also report lower patient satisfaction and feel they may be more susceptible to medical error and providing poorer quality care [16,17]. Surgeons, specifically, may experience negative impacts on both their technical and cognitive intraoperative performance, with serious consequences to their patients [18]. Suboptimal physician well-being may also lead to interpersonal relationship issues, diminished productivity, and ultimately, the decision to leave medicine and surgery [2,19,20].

On the other side, when perioperative complications occur, they cause severe mental distress to the responsible surgeons. Except for the subsequent measures after severe postoperative complications, such as medical dispute, malpractice liability, lawsuit litigation, violent doctor–patient conflicts, economic compensation, surgeon's compensation, and punishment by hospitals, these adverse events could greatly influence the mental health of the involved surgeons [21-24]. In one study, it was identified that the surgeons from small community hospitals (usually no university affiliation), junior surgeons, and existing violent doctor–patient conflicts were independent risk factors

of surgeons' severe mental distress after a complicated postoperative period [15].

Burnout is a Quantitative Entity

The most widely used, well-validated instrument for the assessment of burnout is the Maslach Burnout Inventory (MBI) [25]. Using this 22-item tool, responders rate the frequency with which they experience various feelings or emotions on a 7-point Likert scale with response options ranging from "Never" to "Daily." Higher values of depersonalisation (MBI-DP) and emotional exhaustion (MBI-EE) and lower values of personal accomplishment (MBI-PA) are indicative of burnout. This instrument has been used in numerous previous studies of physicians,and many evaluations of burnout have focused on the presence of high levels of either emotional exhaustion or depersonalisation as a cornerstone of burnout among medical professionals [26-29].

Since the details of how the severity of burnout is assessed by using the Maslach Burnout Inventory are outside the purpose of this work, the interested readers are referred to the relevant articles in the References section [25-32].

Tools and Techniques for a Sustainable "Well-Being"

The quality of life of surgeons is an extremely important and decisive factor that determines the quality of care that they deliver to their patients. Towards that direction, individuals, societies, and organisations are providing strategies and programs that promote tools and techniques to ensure well-being and consequently good QOL [30].

As surgeons, we should recognize the need to foster well-being, resilience, and work-life integration, regardless of our career stage, practice setting, specialty, and/or professional aspirations. Fostering the growth of both our surgical expertise and our personality as a whole is paramount. We should recognize that many factors affect our emotional, occupational, physical, intellectual, financial, social, spiritual, and environmental well-being, both as surgeons and as human beings [31]. Establishing strategies to minimize the burden of burnout and poor QOL relies on a thorough understanding of QOL in our profession.The following consists of the basic components that promote a surgeon's well-being.

- Workload management: reasonable hours, support teams, better scheduling
- Mental health support: counseling services, peer support groups, destigmatising therapy
- Physical health: ergonomics in the OR, promoting exercise and sleep
- Professional fulfillment: ensuring surgeons feel valued, have autonomy, and maintain a sense of purpose
- Organisational culture: creating environments where it's okay to ask for help or admit when things are tough
- Resilience training: mindfulness, stress management techniques, cognitive behavioral skills
- Career flexibility: allowing shifts in roles over time (e.g., teaching, research, leadership)

The successful implementation of such a well-being program requires systemic changes rather than expecting individual surgeons to just be "tougher" — because resilience (for example) alone isn't enough if the system is broken.

Mindfulness can support the well-being of surgeons. When we experience stress, we can become caught up in it, and we do not realise how the stress affects physical discomfort and connects to our emotional state. A body scan meditation can help release physical tension, even the tension we do not realise we are experiencing, and reconnect us with our bodies.

Mentally scanning ourselves allows us to bring awareness to each part of our body, to notice any aches, pains, tension, or discomfort, and to get to know the pain and learn from it, so we can manage it. At all career levels, it is important to pursue pursuits outside the workplace and the OR and share our passions and interests with family and friends.

It is also well known that gender has a complex impact on work–life integration [30]. Akazawa et al. argue for support systems, such as education systems, mentorships, and promotions, to enable female doctors to hold academic positions [32]. Chesak et al. identified specific interventions to prevent burnout in female physicians by: a) removing barriers to career satisfaction, work–life integration and mental health; b) identifying and reducing gender and maternal biases; c) mentoring and sponsorship opportunities; and d) family leave, breastfeeding and child care policies and support [33].

Balance Versus integration

The term "work–life balance", as discussed in the introduction, entails inconsistency when talking about working conditions. Work should not be the counterpart to life, and an integration of work into life seems to be more than desirable. Work–life integration is the desirable goal in different professions. A stable work–life integration would promote well-being, productivity, satisfaction, and patient care [30].

The primary sources of one's quality of life are primarily work, family, and the social environment. Each of these contributes differently depending on the individual's age

and circumstances. As surgeons, we must exemplify good health for our patients and future generations of surgeons. To provide the best care for our patients, we need to remain alert, engaged in our work, and prepared to meet our patients' needs. In this regard, individuals, communities, and organisations should implement strategies and programs that promote work–life integration [34].

Concluding Remarks

The following recommendations pave the way that ensure good QOL with its beneficial consequences for the surgical community:

a) Physical health, by maintaining good physical condition through regular exercise, proper nutrition, and adequate sleep.
b) Mental health by managing stress, anxiety, and burnout through mindfulness, counseling, and support systems
c) Work-life integration, by ensuring enough time for family, hobbies, and rest to avoid chronic fatigue.
d) Professional support by having access to mentorship, peer support groups, and continuing medical education.
e) Institutional environment where workplaces should foster surgeon-friendly cultures, reasonable work hours, and resources for mental health.

Conflicts of Interest: *None*

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Case Report

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A rare case of mixed oesophageal tumour: Presentation of diagnostic and therapeutic approach

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ABSTRACT

Mixed Neuroendocrine-Non-Neuroendocrine Neoplasm (MiNEN) of the oesophagus is an especially rare malignancy. It is composed of an adenomatous and a neuroendocrine aspect. Each histologic subtype contributes at least 30% of the immunohistopathologic features to the complex profile of these mixed neoplasms. Given the small number of cases in the existing literature and the lack of international guidelines, diagnosis and treatment may vary among different centers; however, a combined approach based on surgical resection and systemic therapies is usually the preferred pathway. In this paper, we present the case of a 68-year-old male who was initially diagnosed with oesophageal adenocarcinoma and was treated with neoadjuvant chemotherapy and oesophagectomy. After the histopathologic examination of the specimen, the tumour was histologically characterised as MiNEN and the patient underwent adjuvant therapy. Multimodal management and tailored treatment are essential in these complex cases since preoperative staging poses challenges and limitations.

Key Words: *Mixed oesophageal neoplasm; neoadjuvant chemotherapy; surgical treatment; adjuvant chemotherapy*

INTRODUCTION

Oesophageal cancer is the eighth most frequently diagnosed cancer globally. The high mortality rate of this type of cancer is due to the advanced stage at presentation [1-3]. Squamous cell carcinoma and adenocarcinoma are the most common histologic types. Other less frequent types are neuroendocrine carcinomas (NECs), lymphomas and sarcomas. Another rare type of oesophageal cancer is mixed neuroendocrine-non-neuroendocrine neoplasm (MiNEN).

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Adenocarcinoma is the second most common neoplasia of the oesophagus and is associated with several risk factors, including gastroesophageal reflux disease (GERD), the Caucasian race, obesity and tobacco use [1,2].Typical symptomatology of adenocarcinoma includes worsening dysphagia, unintentional weight loss and fatigue [1,2]. In most cases, the symptoms appear at an already advanced stage, with poor prognosis [1,2]. Adenocarcinoma presents an aggressive pattern of metastasis and affects regional lymph nodes, the liver, the peritoneum and in rare cases the brain [1]. Oesophageal adenocarcinoma has a consistent cytokeratin expression pattern of CK7+, CK19+ and CK20- (3258 WHO) [4].

On the other hand, oesophageal NEC is a rare type of oesophageal cancer mainly located in the middle and distal oesophagus [5,6]. Most patients remain asymp-

tomatic, whereas dysphagia, weight loss and abdominal discomfort may be present.NEC is usually positive on histologic findings for chromogranin A, synaptophysin and CD56. Proliferation marker Ki67 or a mitosis index higher than 20% contribute to the diagnosis. A percentage lower than 20% indicates neuroendocrine tumour (NET) [8]. NEC most commonly metastasises to regional or distant lymph nodes or the liver [5,6].Although there is no consensus on the optimal treatment algorithm, a combination of neoadjuvant/adjuvant chemo/chemoradiotherapy and surgical resection is the most common treatment approach [5,6,8]. According to the National Comprehensive Cancer Network(NCCN) guidelines for neuroendocrine carcinomas, also with MiNEN and large or small cell carcinomas, CT or MRI scans are used to evaluate whether the tumour is resectable, in which case the treatment includes a combination of surgical resection, adjuvant and neoadjuvant chemotherapy, based on etoposide and platinum based chemotherapy, and radiation or chemotherapy and chemoradiation alone, all followed by strict surveillance of the patient on a three-six month basis. In contrast, neoplasms found to be locoregional but unresectable or metastatic are treated using chemotherapy, radiation, immunotherapy and targeted therapy, also followed by surveillance ranging from a monthly to a four month basis [9].

MiNEN of the oesophagus is a histologically heterogeneous neoplasm that presents both adenomatous and neuroendocrine differentiation, which are identified both morphologically and immunohistochemically (by synaptophysin and/ or chromogranin expression), each representing at least 30% of the tumour [4,10]. MiNEN is three to four times more common in men. Oesophageal MiNEN is extremely rare [10]. This malignancy is diagnosed microscopically with the use of neuroendocrine (CD56, chromogranin and synaptophysin) and non-neuroendocrine (CK7, CK20 and CEA) markers [10]. Due to the rarity of this malignancy, there are no specific treatment guidelines. Hence, the treatment plan is individualized and primarily tailored for the most aggressive component of the tumour, which could be either the adenomatous or the neuroendocrine component [11]. In our case, the neuroendocrine component was identified as the more aggressive element.

In this case report, we present a 61-year-old male patient with oesophageal cancer that underwent oesophagectomy, but was eventually diagnosed with MiNEN on histopathological examination. The aim of this report is to demonstrate this rare type of oesophageal cancer as well as the importance of personalised treatment to achieve the best possible prognosis.

CASE REPORT

A 61-year-old male patient presented to the hospital reporting three-month worsening dysphagiato solid food, and unintentional weight loss of 6 kilograms within two months. Biochemical examination showed mild anaemia-haematocrit (37%), hemoglobin (11,8 g/dl), MCV (70,9 fL), MCH (22,6 pg/cell) and elevated CRP (96,3 mg/L). Tumour markers CEA and CA19-9 were found to be mildly elevated (22,3 ng/ml and 59,1 IU/ml respectively). The patient's personal history included arterial hypertension and an angioplasty that had taken place 15 years prior. Firstly, a CT scan reported a mass at the level of the gastroesophageal junction. A PET/CT scan was then performed which revealed a lesion on the cardioesophageal junction with high 18F-FDG uptake (cT3N0M0) (Figure 1).

Histology of the lesion disclosed adenocarcinoma, positive for HER-2 expression with a HER-2 score of 3+, and the patient underwent neoadjuvant chemotherapy with four cycles of the FLOT scheme, consisting of fluorouracil, leucovorin, oxaliplatin and docetaxel. After restaging, the patient underwent Ivor Lewis oesophagectomy. Surprisingly, the histopathology of the specimen showed MiNEN. More precisely, the tumour was a combination of 40% adenocarcinoma with moderate differentiation while the rest 60% was composed by large cell neuroendocrine carcinoma(LCNEC), with medium-to-large sized atypical cells, prominent nucleoliand increased number of mitosis (>20 mitosis/ 10 HPF), which were organised in rosetoid-like and solid formations with central necrosis. The tumour was invading both the submucosal layer and the muscle wall of the oesophagus and was located 2,5 cm above the z-line, measuring 4,9 cm x 2,9 cm. Six out of 17 perigastric lymph nodes were infiltrated by the adenocarcinomatous aspect of the lesion, whereas a periesophageal lymph node was infiltrated by the neuroendocrine aspect of the cancer. Therefore, the TNM staging was pT2N3. Immunohistochemical evaluation of the specimen indicated positivity for CK7 and CK8/ 18 in the adenocarcinoma component and positivity for chromogranin, synaptophysin in few cells and CD56 in the LCNEC component. The Ki-67 index of cell proliferation was 80% for the neuroendocrine part of the tumour and 55% for the adenocarcinoma (Figure 2).

Targeted chemotherapy for the neuroendocrine component of the tumour was added, consisting of three cycles of carboplatin and etoposide. A few months later, a routine follow-up PET/CT scan revealed an enlarged lymph node at the left paraaortic space (5,4 x 3,6 cm and SUVmax: 10.8), an enlarged lymph node behind head of the pancreas (1 x 0,8 cm and SUVmax: 3,2) and a high 18F-FDG uptake nodular lesion at the left posterolateral thoracic wall (0,9 x 0,4 cm and SUVmax: 3,3). Following multidisciplinary

FIGURE 1. PET/CT scan that was performed when the patient was firstly diagnosed with the disease. A lesion with high absorption of 18F-FDG and thus elevated SUVmax can be observed in the gastroesophageal junction.

meeting and multimodal decision-making, cisplatin, pembrolizumab and herceptin were administered. A second PET/CT scan was performed a few weeks later and confirmed that the metastatic lesions had exhibited no progression. At the same time, a new metastasis was identified in the right latissimus dorsi (2,7 x 1,8 cm and SUVmax: 8,1). The figures below depict the differences between the first and the second PET/CT scan that were done post-operatively (Figures 3,4).

After the second PET/CT scan, an excisional biopsy was performed on the right subcutaneous thoracic lesion. The findings were consistent only with the adenocarcinomatous type of cancer and therefore famderuxtecan was administered.

During the following months, the patient underwent various follow-up PET/CT and MRI scans which showed

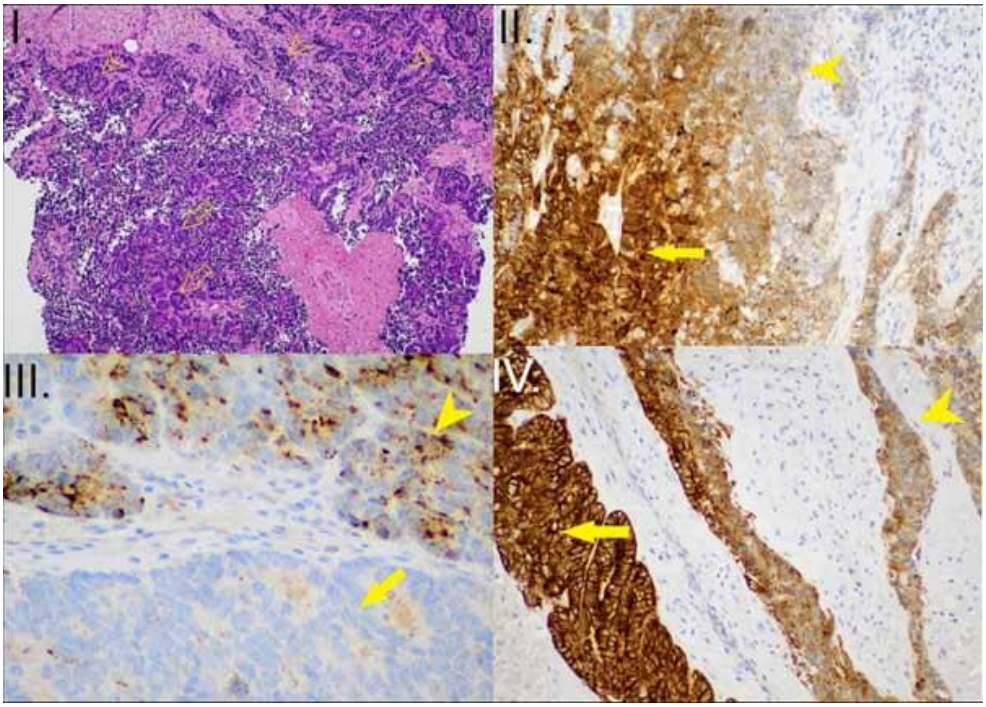

FIGURE 2. I. Mixed Neuroendocrine-Non-Neuroendocrine Neoplasm (MiNEN) (HE x100): The epithelial component is a high-grade adenocarcinoma (arrows). The neuroendocrine component is a Large Cell Neuroendocrine Carcinoma (LCNEC) (arrowheads) II. MiNEN (CK7 x200): positive in the adenocarcinoma component (arrow) and negative in the LCNEC (arrowhead) III. MiNEN (Chromogranin x200): negative in the adenocarcinoma component (lower part of the image - arrow), positive in the LCNEC (Antibody binds acidic glycoproteins in the soluble fraction of neurosecretory granules - arrowhead) IV. MiNEN (CK8/ 18 x200): intense, diffuse pattern of expression in the adenocarcinoma component (arrow), granular pattern of expression in the LCNEC (arrowhead).

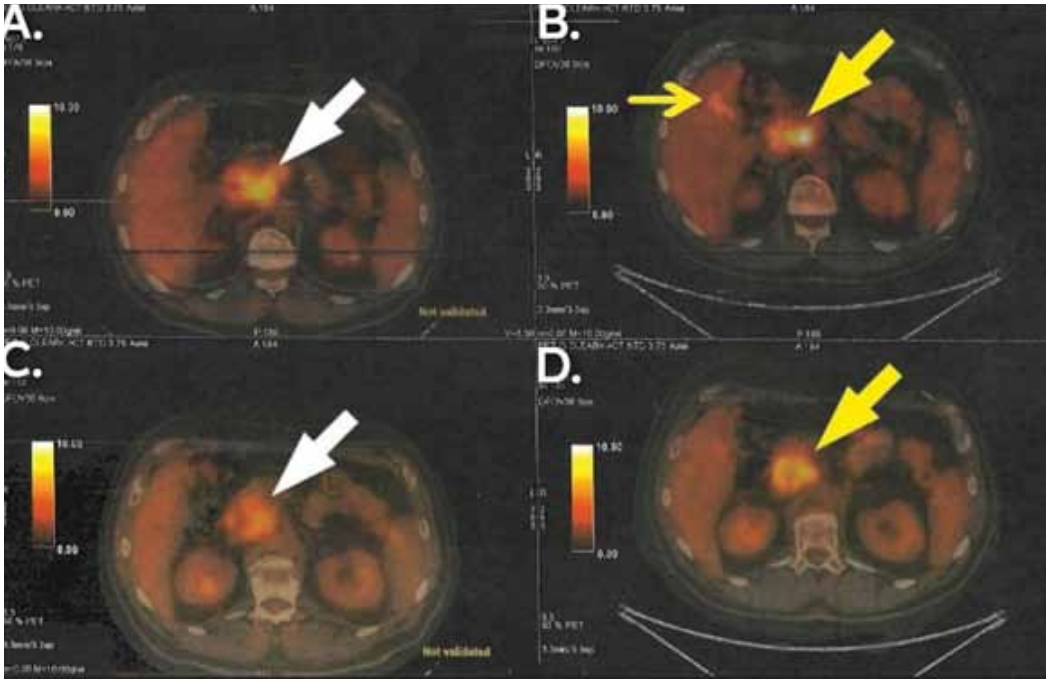

FIGURE 3. PET/CT showing the findings after the first and the second schemes of adjuvant therapy and their relapses, respectively (B and D show the first relapse and A and C show the second relapse). Enlarged paraaortic lymph nodes and a mass in the lumen of the right colic flexure(big and small yellow arrow in B) and enlarged lymph nodes behind the margin of the head and body of the pancreas (big yellow arrow in D) were findings of the first relapse. Further enlarged paraaortic lymph nodes with higher SUVmax(big white arrow in A) and further enlarged posterior pancreatic lymph nodes, behind the margin of the head and body of the pancreas, (big white arrow in C) were findings of the second relapse.

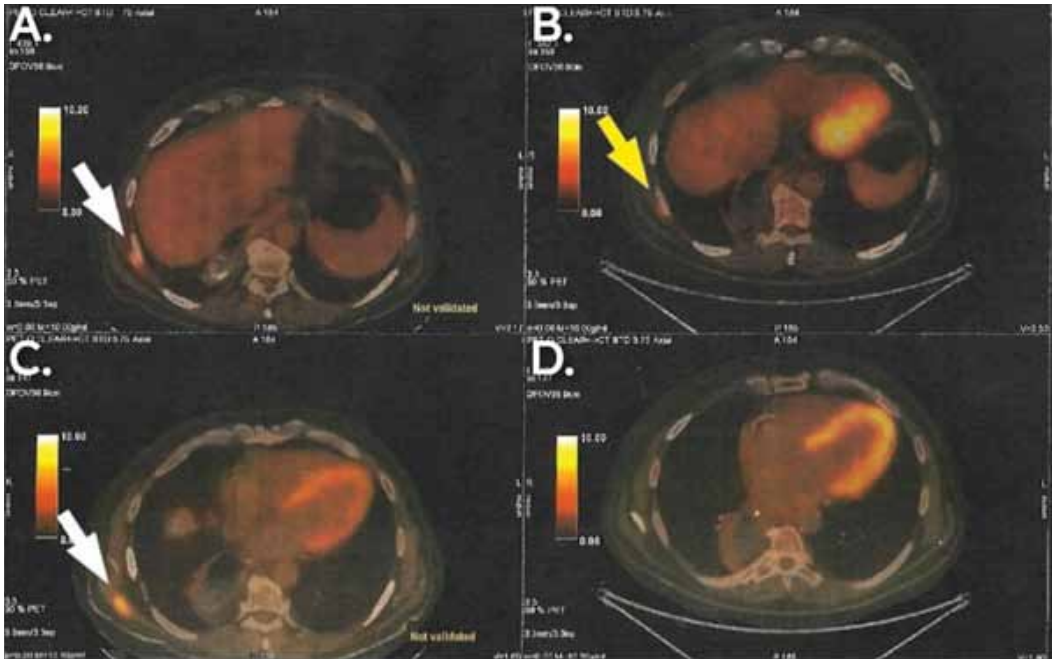

FIGURE 4. PET/CT showing the findings after the first and the second schemes of adjuvant therapy and their relapses respectively(B and D show the first relapse and A and C show the second relapse). Subcutaneous mass in the lateral and posterior thoracic wall (big yellow arrow in B) was the finding of the first relapse. An even larger subcutaneous mass in the lateral and posterior thoracic wall (white arrow in A) and an independent mass in the posterior thoracic wall in contact with latissimus dorsi (white arrow in C, absent in D) were the findings of the second relapse.

a variety of results, including both progression and regression of the lesions and also received many different therapeutic regimens. The most recent PET/CT scan shows worsening of the patient's lesions and new findings including nodular masses in the upper lobe of the right lung and pleura and a lesion anterior to the left adrenal gland. Currently the patient is still under therapy with Nivolumab and Abraxane.

DISCUSSION

MiNEN constitutes only a small percentage of oesophageal neoplastic diseases. Nevertheless, its non-specific symptomatology, the increased difficulty of differential diagnosis with other types of cancer of the oesophagus and the need for individualised therapy make it an interesting clinical entity [10]. In our case there are several teaching points. Firstly, regarding the expression of biomarkers, the main characteristics of the patient's lesion were positivity for HER-2 (score: 3+) and negativity for Microsatellite Instability (MSI). Biomarkers are a useful tool that can be used for the prognosis and the treatment of oesophageal cancer [12-14]. Specifically, there are many immunohistochemical methods that can determine which biomarkers are expressed by the tumour cells. Of particular interest are PD-L1, CTLA-4, HER-2 and MSI. Firstly, the PD-1/ PD-L1 system has a negative prognostic value, since it is associated with higher recurrence rates post-operatively, as it inhibits the function of anti-tumour immune T-cells and leads to proliferation of malignant cells [12,13]. This system can be used as a target for immunotherapeutic schemes in neoadjuvant and adjuvant treatment, implementing either anti-PD-1 or anti-PD-L1 agents, such as pembrolizumab and avelumab respectively, which activate the patient's immune system, by triggering a T-cell dominant response that is more tumour-specific [13,14]. Despite its efficacy as shown by clinical trials, this method of immunotherapy was until recently mainly used for advanced metastatic patients and therefore needs further investigation before perioperative implementation as a standard way of treatment [12,13]. Similar to PD-1/ PD-L1, CTLA-4 is another biomarker, located on T-cells, which also inhibits their function when bound to proteins expressed by cancer cells. Inhibitory monoclonal antibodies such as ipilimumab prevent the upregulation of CTLA-4 [13]. Human Epidermal Growth Factor Receptor-2 (HER-2) is another crucial biomarker expressed in oesophageal cancer cells, which regulates cell growth and thus constitutes an important target for targeted therapy [15]. HER-2 inhibitory drugs and namely trastuzumab show increased patient survival when used together with chemotherapeutic schemes. Lastly, Microsatellite Instability (MSI) described by deficiency of DNA-mismatch repair proteins (dMMR), although not a target for specific immunotherapy, is associated with higher overall survival for patients and therapy response, compared to Microsatellite Stable patients (MSS) [12,13].

Secondly, regarding the infiltration of the lymph nodes, both the adenocarcinomatous and the neuroendocrine part of the cancer were found to contribute to this aggressive metastatic pattern**.** As observed, using only imaging diagnostic techniques can lead to clinical mis-staging of the tumour. In our case, the initial CT and PET/CT that was performed was unable to detect infiltrated lymph nodes, which were later found positive for metastasis in the pathologic examination (pT2N3M0). These shortcomings that emerge from the mismatch of the cTNM and the pTNM staging have been described in the literature. CT scan is deemed unable to differentiate between T1, T2 and T3 regarding oesophageal cancer, whereas changes in adjacent structures of the oesophagus are the ones indicating T4 staging. Additionally, CT has low sensitivity for nodal staging and it is the first to be used for detection of metastasis, followed by PET, for added diagnostic value [16]. Having mentioned PET scan, it has a very low impact in determining the T category of the tumour and is characterised by high specificity but low sensitivity for nodal staging, while providing information about the metabolic activity of the tumour cells [16]. Lastly, another imaging technique is the endoscopic ultrasonography (EUS), with high contribution to the tumour staging being able to define the T stage and discern more accurately between T1a and T1b, with varied sensitivity and specificity according to different papers, and it also can help determine the nodal staging, depicting the internal characteristics of infiltrated lymph nodes [16]. The low sensitivity of these imaging techniques renders histological confirmation by biopsy necessary in order to have an accurate clinical staging. However, even biopsies have limitations in detecting both components, therefore it is not uncommon to misdiagnose a tumour, as it happened in our case as well [11].

Lastly, one of the most intriguing findings is the soft tissue metastasis in the posterolateral and posterior thoracic wall at a later stage of disease progression which was successfully discovered with the use of PET/CT scan.

The existing literature on this uncommon entity remains scarce. Kawazoe T, Saeki H, Edahiro K, et al., 2018, report a case of a 70-year-old male patient with MiNEN and Barrett's oesophagus. The patient was treated with an oesophagectomy and regional lymph node dissection [17]. According to another report, a 68-year-old man with a two month history of postprandial pain and vomiting was diagnosed with a neuroendocrine carcinoma. The tumour was positive for chromogranin. This patient was

TABLE 1. Summary of characteristics of case reports describing Mixed Neuroendocrine-Non-Neuroendocrine Neoplasms (MiNEN).

Authors	Year of publication	Tumour location	TNM Stage	Histologicalcomponents	Immunohistochemistry	TreatmentApproach	PatientOutcome
Kawazoeetal. [17]	2018	Left wall of the lower third of the oesophagus	T1N0M0	Well to moderately differentiated adenocarcinoma Small cell NEC	Adenocarcinoma: (-) Small cell NEC: Synaptophysin (+) Chromogranin A (-) p40 (-) Ki67 index: 50%	Distal oesophagectomy Proximal gastrectomy Regional lymph node dissection Closefollow-up	Uneventful postoperative course Discharged on the 19th postoperative day No sign of recurrence after 4 months
Kadhimetal. [18]	2016	Distal oesophagus GEJ	NA (Lymph node metastases present)	Highlydifferentiatedadeno-carcinoma NEC	Adenocarcinoma: (-) NEC: Synaptophysin (+) Chromogranin A (+) Ki67 index: Up to 50% 17 mitosis/10 HPFs	Macroradicaltransthoracic oesophagus resection	NA
Mendoza-Morenoetal. [10]	2018	GEJ	T3N2M0	60% Moderately differentiated adenocarcinoma 40% Well differentiated NEC	Adenocarcinoma: (-) NEC: Synaptophysin (+) Chromogranin A (+)	NA	Uneventful postoperative course Discharged on the 10th day of admission
Golombeketal. [19]	2019	GEJ (Siewert type 1)	NA (Distant-metasta-sespresent)	Highly differentiated adenocarcinoma Small cell NEC	Adenocarcinoma: HER2/neu: 3+ score Small cell NEC: Ki67 index: >70%	Palliative therapy First line Chemotherapy: Cisplatin, Etoposide Change due to Cisplatin adverse effects: Carboplatin, Etoposide, Trastuzumab Second line Chemotherapy: Topotecan ThirdlineChemotherapy: VDC	After first line chemotherapy: Cisplatin associated orbital and optic nerve toxicity Treated with cortisone therapy Tumor progression could not be halted despite escalation of therapy Patient died 9 months after presentation
Gushimaetal. [20]	2022	Lower thoracic oesophagus	T1N0M0	35% Welldifferentiatedtubu-lar adenocarcinoma 65% NEC	Adenocarcinoma: (-) NEC: Synaptophysin (+) Chromogranin (+) NCAM (+) Ki67 index:Upto>80%	ESD Closefollow-up	No signs of recurrence 2 years after treatment

NEC: Neuroendocrine Carcinoma, GEJ: Gastroesophageal junction, NCAM: Neural Cell Adhesion Molecule, NA: Not Available, HPF: High Power Field, VDC: Vincristine, Doxorubicin, Cyclophosphamide, ESD: Endoscopic Submucosal Dissection

also treated with transthoracic oesophagectomy, with no neoadjuvant treatment. Later, biopsy of the resected specimen showed MiNEN [18]. Mendoza-Moreno F, Díez-Gago MR, Mínguez-García J, et al., 2018, reported a 68-year-old man with mixed adenoneuroendocrine characteristics confirmed in the specimen of oesophagectomy [10]. Golombek T, Henker R, Rehak M, et al., 2019, presented a case of a 60-year-old male with upper abdominal pain, in whom a mass in the gastroesophageal junction was found via endoscopy (Siewert type 1). Pathologic examination of the lesion confirmed it as a HER/neu positive MiNEN and further, imaging via CT and PET/CT scan showed metastasis to the liver and multiple lymph nodes. The patient underwent chemotherapy with three different regimes, (first line therapy: cisplatin and etoposide with palliative intent, with later addition of trastuzumab, second line therapy: topotecan, third line therapy: doxorubicin, cyclophosphamide, and vincristine), with no major improvement and died due to further tumour progression and health deterioration [19]. Lastly, another paper describes a 92-year-old male patient who was diagnosed with MiNEN T1N0M0, in the context of investigation of an oesophageal lesion. Endoscopic submucosal dissection was performed and pathologic examination confirmed the diagnosis of MiNEN. No further treatment was administered, and no recurrence was observed two years post-resection [20].The characteristics of these five case reports are summarised in Table 1. It is also noteworthy that histopathological differences were observed both in our case and several others, between the endoscopic biopsy and the final organ pathology, a result indicative of the difficulty to preoperatively characterise the tumour [10,18].

Oesophageal MiNENs usually consist of poorly differentiated NEC and either squamous cell carcinoma or adenocarcinoma (in Barrett mucosa or ectopic gastric mucosa) (3371 WHO) [4]. For a neoplasm to qualify as a MiNEN, both components should be morphologically and immunohistochemically (by synaptophysin and/or chromogranin expression) recognisable. Both components are usually carcinomas; therefore, the neuroendocrine component is classified as a poorly differentiated neuroendocrine carcinoma (NEC), which may present either large cell NEC (LCNEC) or small cell NEC (SCNEC). Carcinomas previously treated with neoadjuvant therapy are not considered MiNENs, unless the diagnosis of MiNEN is established based on a pretreatment specimen, because the neuroendocrine morphology exhibited by some treated carcinomas may not have the same prognostic significance as that seen in a de novo component of NEC [4].

In summary, despite its rarity, MiNEN is a present clinical entity, which should be part of the differential diagnosis of the clinical doctor since its differences from other oesophageal neoplasms, especially regarding its treatment, modify completely the decision-making, the treatment regimens and prognosis. Therefore, multimodal consultation and collaboration among specialists are deemed to be necessary.

CONCLUSIONS

In conclusion, MiNEN is a rare type of gastrointestinal tract cancer with positive immunohistochemical markers for both non-neuroendocrine and neuroendocrine components. In this paper, we report one of the more uncommon presentations of this oncological entity that concerns the oesophagus. Awareness and thorough endoscopic investigation and imaging studies with accurate staging are key in the final diagnosis and combination of treatment pathways. Nevertheless, the limited number of reported cases in the literature forces us to be skeptical about the protocols implemented. It is also important to highlight that, due to the complex nature of such cases, a multidisciplinary approach as well as an individualized therapeutic plan are of utmost importance. Ultimately this paper emphasises the need for further research on this clinical pathology due to the lack of literature.

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Case Report

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Laparoscopic assisted Deloyers procedure as a salvage technique for an unexpected intraoperative finding during a laparoscopic left hemicolectomy: A case report

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ABSTRACT

Managing a short proximal colonic segment after an extensive left sided colon resection may be challenging. Total colectomy with ileorectal anastomosis (TC-IRA) is an option, but at the cost of sacrificing the whole colon and the ileocecal valve. Two organ- preserving alternatives are the Deloyers procedure (DP), which involves mobilisation and cranio-caudal rotation of the right colon around the axis of the ileocolic vessels and the retroileal trans-mesenteric method described by Turnbull. DP has been shown to be safe, with fewer postoperative bowel movements (average 3.5 with a median of 2-3 in DP versus average 4-6 with a median of 5 in TC-IRA) and equivalent anastomotic leak rates (<5%) compared with TC-IRA. Herein, we present a patient with a left

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colon adenocarcinoma, who was initially planned for a laparoscopic left hemicolectomy but intraoperatively converted to a laparoscopic assisted Deloyers procedure due to adverse intraoperative findings. This case highlights the feasibility of minimally invasive, assisted techniques in salvage settings and underscores the importance of colorectal surgeons being well-versed in this procedure, both open and laparoscopically, as it helps preserve colonic physiology and leads to improved functional outcomes.

Key Words: *Case report; Deloyers; colon cancer; salvage; colonic inversion*

INTRODUCTION

Performing extended left-sided colon resections and creating a tension-free anastomosis can be challenging, demanding both expertise and a thorough understanding of the anatomy. An extended left colectomy, whether planned preoperatively or determined intraoperatively, may leave the proximal colonic segment too short to reach the rectal stump without excessive tension, making the subsequent anastomosis risky [1]. Many surgeons therefore prefer to construct a total colectomy with ileorectal anastomosis (TC-IRA) [1]. This leads, however, to impaired bowel function, with persistent frequent bowel movements that negatively impact quality of life (QoL) over the long term [2].

Two traditional techniques are available to preserve the proximal colon while providing additional length to reduce tension in the anastomosis. The retroileal trans-mesenteric method, first described by Turnbull in 1978, involves creating a "window" in the terminal ileal mesentery and pulling the transverse colon through it into the pelvis [3]. The Deloyers procedure (DP), introduced in 1964, entails complete mobilisation of the right colon, which is then rotated 180 degrees counterclockwise around the axis of the ileocolic vessels to facilitate a colorectal or coloanal anastomosis [4]. Although these are old well described procedures, they were relatively abandoned in the past. In recent years however, they are used more frequently since conservation of as much gastrointestinal physiology as possible is thought to contribute to a better QoL. DP has been shown to be safe, with decreased postoperative bowel frequency and equivalent anastomotic leak rates compared with TC-IRA.

We report a case of a female patient with a left colon adenocarcinoma who was initially planned for a laparoscopic left hemicolectomy and was later converted to a laparoscopic assisted DP, due to unexpected intraoperative events.

This case highpoints the feasibility of minimal invasive assisted techniques in salvage procedures and highlights the importance of familiarity of colorectal surgeons with the DP, both open and laparoscopically, since it can restore the continuity of the gastrointestinal tract with a tension free anastomosis and with preservation of the ileocecal valve and colonic physiology.

Case presentation

A 71-year-old female patient, with a descending colon adenocarcinoma was admitted in our Surgical Department for surgical management.

One week prior to admission, she underwent a colonoscopy due to persistent anaemia. Near the hepatic flexure, it revealed a 3 cm sessile serrated lesion (SSL), occupying approximately 50% of the luminal diameter, which was subjected to endoscopic mucosal resection (EMR). At 50 cm from the anal verge, a 2 cm Paris IIa+c polyp was identified, biopsied and a tattoo was applied proximally. At 35 cm from the anal verge, a 1.5 cm Paris IIa polyp was observed and was biopsied. Histopathological examination of the Paris IIa+c polyp confirmed the presence of moderately differentiated adenocarcinoma. Both the 3cm SSL and the1.5 cm Paris IIa polyp were benign adenomas.

Upon her admission, she underwent a thorough physical and pre-operative work up. Her medical history consisted of mild idiopathic hypertension, controlled with nifedipine, dyslipidaemia and obesity with a basal metabolic index (BMI) of 34. She had two natural births at the age of 29 and 31 and she had undergone an open appendectomy more than 20 years ago. She had never smoked and she was a social drinker. Her family history was insignificant with no cancer prevalence among first degree relatives. On clinical examination, her abdomen was soft, non-tender with no identifiable masses and digital rectal examination did not reveal any pathology. The remainder of the physical assessment was unremarkable. Tumour markers CEA, CA 19-9, CA125 and CA15-3 were within normal values.

On the second day of her admission, abdominal and chest contrast-enhanced computed tomography (CT) imaging were obtained and did not reveal any lymphadenopathy or distant metastases. On the next day, the case

was presented to the multidisciplinary team (MDT) and a laparoscopic left sided colon resection was decided

The following day, the patient was transferred to the operation theater and positioned in a modified lithotomy position. A supraumbilical camera port was inserted via the Hasson open technique. Pneumoperitoneum of 14mmHg pressure was established and additional laparoscopic ports were placed; 5 mm in the left iliac fossa, 12 mm in the right iliac fossa, and 5 mm in the right upper quadrant. Initial laparoscopy revealed no peritoneal metastases or other suspicious lesions. The site of a previous appendectomy was noted, along with dense adhesions between the omentum, the left colon and the spleen. Adhesiolysis was performed and a tattoo marking at the junction of the sigmoid/ descending colon was visualised. The inferior mesenteric artery (IMA) pedicle was identified, and a surgical plane was developed between the posterior peritoneum and the Gerota's fascia. The left ureter and ovarian vessels were identified and preserved. The dissection continued along the previous plane and the IMA was clipped and divided at its origin. A distinct inferior mesenteric vein was not visualised. During lateral mobilisation, detachment of the transverse colon from the spleen revealed a second tattoo, which was not mentioned in the preoperative colonoscopy report. It was sited proximal to the splenic flexure, requiring an extended left hemicolectomy. Transverse colon was further mobilised, and the middle colic vessels were clipped and divided. The transverse mesocolon was detached from the pancreas, the site of division was marked and the colon was transected with a linear stapler, just distal to the hepatic flexure. Due to the short length of the remaining transverse colon and the anticipated tension on the future anastomosis, a salvage Deloyers procedure was scheduled. Further mobilisation of the caecum and the right colon was performed. The mesocolon was transected near the bowel with division of the right colic vessels, while preserving arterial supply through the marginal artery and the ileocolic vessels.

At this stage, the surgical team was notified by the anaesthesiologist that there were ventilation issues and high blood carbon dioxide (CO_2) levels. After a failed trial of lowering pneumoperitoneum pressure to 10mmHg and avoiding steep Trendelenburg position, the rest of the procedure was converted to open. A midline supra- and infraumbilical incision was performed, the specimen was delivered through the incision and resection was completed with distal transection at the level of the upper rectum, using a circular stapler. Using the ileocolic vessels as an axis, the colon was inverted caudo-cranially by 180 degrees in the sagittal plane, thereby repositioning the caecum to a subhepatic location and the transverse colon into the pelvis (Figures 1, 2). A tension-free end-to-end isoperistaltic anastomosis was constructed using a 28 mm circular stapler, reinforcing it with interrupted sutures. Airleak test was negative. A defunctioning stoma was deemed unnecessary. Meticulous haemostasis was ensured and mesenteric defects were closed. The peritoneal cavity was irrigated and a closed suction drain was placed in the pelvis. Abdominal wall closure was performed and the patient was extubated and recovered uneventfully. The length of the operation was approximately 240 minutes.

Post-operative course was uneventful, with no signs

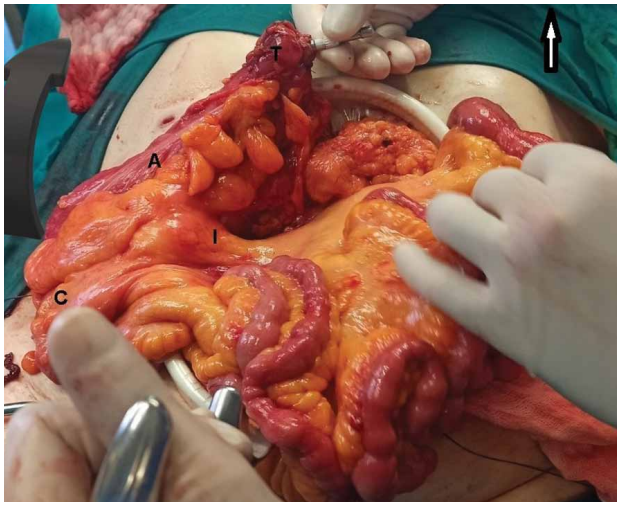

FIGURE 1. Intraoperative view of the proximal colon prior to inversion. Arrow at the upper left corner pointing towards the patient's head. Curved black arrow showing the direction of caudo-cranial inversion A, anterior surface of the proximal colon; C, caecum; T, cut end of the transverse colon; I, ileocolic pedicle.

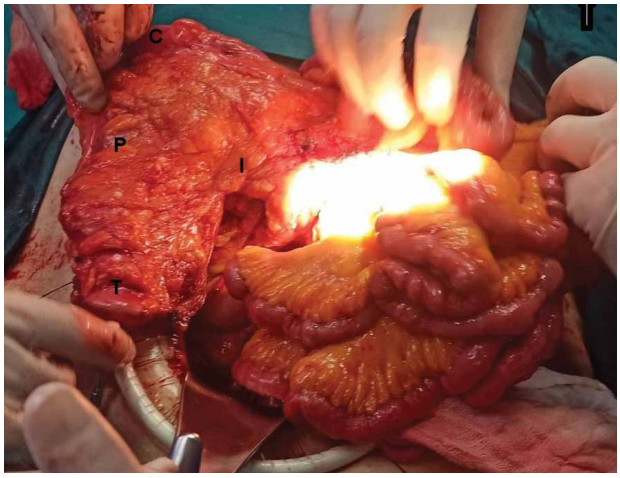

FIGURE 2. Intraoperative view of the proximal colon after inversion. Arrow at the upper left corner pointing towards the patient's head; P, posterior surface of the proximal colon; C, ceacum; T, cut end of the transverse colon; I, ileocolic pedicle.

of anastomotic leak or any other complication. Diet commenced early on the second postoperative day and advanced gradually as tolerated. The drain was removed on the seventh and the patient was discharged on the eighth postoperative day.

Histopathology report showed a pT3N1 moderately differentiated adenocarcinoma of the colon, which corresponded to the more proximal tattoo in the transverse colon. Neoplastic cells were found to infiltrate the full thickness of the colonic wall and extend into the pericolic adipose tissue. There was also evidence of perineural and perivascular invasion, along with vascular emboli containing neoplastic cells. Neoplastic involvement was noted in one of the eighteen (1/18) regional lymph nodes harvested. Resection margins were negative. The tumour demonstrated positive immunohistochemical staining for MSH2, MLH1, PMS2, and BRAFV600E, suggesting proficient mismatch repair mechanisms (pMMR).The distal tattoo that was initially recognised at the junction of the descending/sigmoid colon, corresponded to the 1.5 Paris IIa polyp, which was a benign adenoma. With the biopsy results, the case was re-presented at the MDT meeting and a plan for adjuvant therapy was decided in six to eight weeks after the procedure.

The patient was subsequently re-evaluated at one and six weeks postoperatively before the commencement of the adjuvant chemotherapy. Clinically, she demonstrated a favorable recovery profile, having resumed a standard diet and gained 3 kilograms. Her bowel movements progressively stabilised, returning to a physiological pattern of less than two per day.

DISCUSSION

Initially reported in 1958, colonic derotation, commonly referred to as the Deloyers procedure (DP), has been widely employed to maintain colon length following extensive colonic resections for various conditions both benign and malignant (Table 1).

This procedure entails the complete mobilisation of the right colon, transection of the middle colic and frequently the right colic vessels, appendicectomy and a 180-degree counter-clockwise colonic rotation in the coronal plane, allowing for a tension-free colorectal or coloanal anastomosis while maintaining adequate perfusion from the ileocolic vessels [4,6]. To preserve bowel function after surgery, the ascending colon is kept as long as possible, with careful attention given to ensuring adequate perfusion of the distal anastomosis, by preserving the marginal artery and the ileocolic pedicle [7]. A modification of this technique, described by Kontovounisios et al., involves a 180-degree craniocaudal inversion in the sagittal instead of the coronal plane, around the axis of the ileocolic vessels, with or without transection of the right colic vessels [8]. In addition to the traditional open approach, the DP has been successfully performed both laparoscopically and robotically.

With respect to the functional outcomes of open DP, two studies demonstrated that the majority of patients experienced a bowel movement (BM) frequency of approximately three times per day; mean 3.5 [19] and median 3 [13], respectively. In a smaller study by Kontovounisios et al., using the modified DP, patients had a median of 2 BM per day [8] (Table 2).

The anastomotic leak (AL) rate in DP with colorectal anastomosis has been reported to be low, but the absence of large-scale studies limits the ability to draw definitive conclusions. In two cohort studies, leak rate was 0% [8,13], whereas a recent study of 97 patients undergoing DP found AL in 5 patients (~5%) [16] (Table 2). With coloanal anastomosis, the risk of anastomotic complications is expected to be higher [17,20]; assessing blood flow to the residual colon and the anastomosis is therefore crucial. Intraoperative indocyanine green (ICG) fluorescence imaging has been found to be a valuable modality for accessing the perfusion in left-sided resections [18]. Late complications of the Deloyers technique include anastomotic stricture and chronic leak, with a reported incidence of 6% and 2% respectively [16].

Comparison between the DP, TC-IRA, and the retroileal trans-mesenteric Turnbull procedure is limited by the absence of large-scale, comparative studies. For the Turnbull technique, with the exception of an old study by Nafe et al. in 1994, which showed an AL rate of 3% [21], no major studies detail functional outcomes or complication rates [22]. A small retrospective study, comparing it with the DP, found no significant differences in the complication rate, including the AL [22].

TABLE 1. Various clinical scenarios that Deloyers procedure has been deployed and the respective references.

Clinical scenarios	References
Severe chronic constipation	[12]
Hirschsprung disease	[5, 28]
Diverticular disease	[8, 13, 19]
Hartmann's procedure reversal	
Previous colorectal anastomosis-related complications	
Malignancy	
Intraoperative extended left colon ischaemia after inferior mesenteric artery high ligation	

TABLE 2. Bowel frequency and leak rates following Deloyers procedure.

Study	Bowel movements/ day(respective sample size)	Average leak rate (respective sample size)
Manceau et al.2012 (13)	Median 3 (48 patients)	0% (48 patients)
Sobrado et al. 2025 (19)	Mean 3.5 (40 patients)	5% (97 patients)
Kontovounisios et al. 2014(8)	Median 2 (14 patients)	0% (14 patients)

Respective data for the TC-IRA are predominantly derived from cohorts with ulcerative colitis, necessitating cautious interpretation. Following this procedure, data from a review article report a bowel frequency of around 4–6 movements/day [23], while a recent study found a median of 5 BM daily [24]; numbers are slightly higher than the respective data observed post-DP (Table 2).Another study, with small sample sizes but not involving patients with ulcerative colitis, found a median of 3.5 BM daily after TC-IRA for colonic cancer, but decreased frequency (median 2.5 movements/ day) if the underlying pathology was diverticular disease or chronic slow transitconstipation with megacolon [2]. AL rates seem to be comparable: a systematic review across 15 studies reported a leak rate of 3.9% after a TC-IRA [25], while another, encompassing five studies, found rates ranging from 1.6% to 5.4% [26]. Analogously, in DP, reported leak rates vary from 0% to ~5% (Table 2). Fewer BM in DP and an equivalent AL rate were also observed in a small comparable study by Carpinteyro-Espin et al. [27].

CONCLUSION

Restoring continuity after extended left colon resections can be particularly challenging. Classically a total colectomy with ileorectal anastomosis (TC-IRA) is performed. Two main alternative techniques have been described that preserve the proximal colon; the retroileal trans-mesenteric method described by Turnbull and the Deloyers procedure that involves a complete mobilisation and rotation of the proximal colon and a colorectal or coloanal anastomosis. Its main advantages are that it spares the ileocecal valve and preserves large bowel length with possibly better functional outcomes compared to an ileorectal anastomosis after a TC-IRA. Leak rates are reported to be low and it has been employed in a variety of clinical situations both for benign and malignant diseases whether planned preoperatively or decided intraoperatively as a salvage procedure, as in our case.

Despite being performed for over six decades, robust, high-quality data on the surgical and functional outcomes of this procedure remain limited. Well-designed large-scale cohort and comparative studies are essential to generate high-level evidence regarding both the procedure itself and its comparison with alternatives such as the Turnbull procedure or the TC-IRA.

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Case Report

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A Rare Case of pancreatic tumor

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ABSTRACT

Many patients are diagnosed with pancreatic lesions nowadays. The differential diagnosis of pancreatic lesions is broad, including both benign and malignant causes. Endoscopic ultrasound (EUS) is a useful diagnostic tool for investigating such lesions, as it offers the advantage of obtaining specimens for histological examination. Here, we present a case of a patient with the rare diagnosis of pancreatic tuberculosis.

Key Words: *Pancreas; tumor; tuberculosis*

INTRODUCTION

The pancreas is a common site of different and various lesions. These lesions can be benign such as IPMN (Intraductal Papillary Mucinous Neoplasm), autoimmune pancreatitis, infections, and others, or malignant, such as adenocarcinoma, neuroendocrine carcinomas etc [1-2]. The most common causes of infection are viruses (CMV, HSV, coxsackie virus, VZV, HIV), bacteria (Legionella, Leptospira, Salmonella, Mycoplasma, Brucella, Salmonella Typhi), fungi (Aspergillus), parasites (Toxoplasma, Cryptosporidium, Ascaris lumbricoides) [1-2].

In some cases, benign pancreatic tumors can mimic pancreatic cancer, and the diagnosis can only be made by obtaining a specimen from the lesion via endoscopic ultrasound (EUS) [2]. Pancreatic lesions are now better understood and more frequently and accurately diagnosed due to Computed Tomography (CT) and Endoscopic Ultrasound (EUS) which provides the ability to take biopsies through Fine Needle Biopsy (FNB) [2-3].

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This case report presents a rare case of a pancreatic tumor, with a non-specific clinical presentation, which was revealed after EUS-FNB to be an unexpected and favorable benign outcome, of pancreatic tuberculosis.

CASE PRESENTATION

A 68-year-old male patient with a medical history of hypertension and dyslipidemia, with no history of immunosuppression or past tuberculosis infection or suspicious travels presented to our endoscopic department to investigate a pancreatic tumor that was found on a Computed Tomography (CT) scan. The initial evaluation of the patient and the prescription of the CT imaging was made by the GP. The symptoms that lead the patient to the GP were fatigue, weight loss (10kg the last 3 months) and mild abdominal pain. The clinical examination revealed stable vital signs and abdominal examination was unremarkable. His complete blood counts, liver function, renal function and coagulation profile were within normal limits. Inflammation markers, such as CRP and ESR, were elevated and specifically 10.90 mg/dl (Normal Values: 0-3mg/dl) and 35mm/hr (Normal values: 0-15mm/hr) respectively. Tumor markers, such as CEA, PSA, and AFP, were unremarkable except for a mild elevation of Ca19-9 which was 44,6 U/mL (Normal values: 0-37U/ml).

The CT that he brought showed a mass lesion in the head of the pancreas (Figure 1A, 1B) measuring 4.0 x 4.5

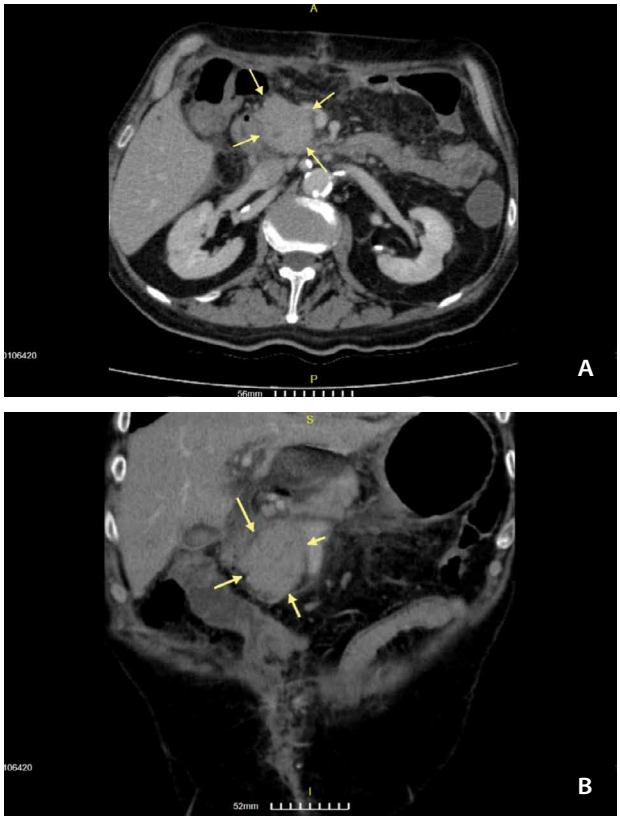

FIGURE 1 A - B. The yellow arrows show the pancreatic tumor that led the patient to EUS-FNB for the final diagnosis.

x 4.1 cm. No other imaging tests have been performed. The EUS revealed a hypoechogenic compact mass with homogeneous texture and longest diameter approximately 4cm, which did not infiltrate the main pancreatic duct, the common bile duct or important blood vessels. The extra-hepatic bile tree was normal. There were no lymph nodes near the pancreas or hepatic lesions that were suspected of metastasis (at the region that we could examine). EUS-FNB performed through the stomach, with a 22-gauge needle, was performed. Pathology test revealed a rare diagnosis and particularly: necrotic granulomatous inflammation, composed of central necrotic zone surrounded by epithelioid histiocytes with varied numbers of multinucleated giant cells and lymphocytes (Figure 2 and 3). Finally, Ziehl-Neelsen staining revealed the diagnosis of pancreatic tuberculosis (Figure 4A, 4B).

DISCUSSION

Tuberculosis (TB) is caused by Mycobacterium Tuberculosis. Most of Tb cases are pulmonary, 20% are extrapulmonary and specifically abdominal TB accounts for approximately 10% of cases [4]. Tuberculosis can affect any intra-abdominal organ. The most frequent cite of

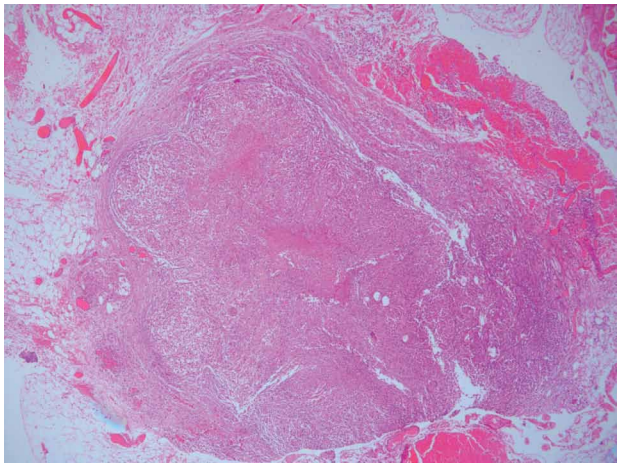

FIGURE 2. Central zone of necrosis.

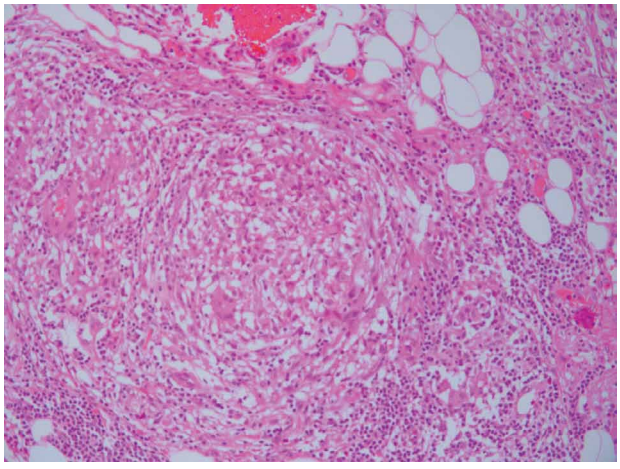

FIGURE 3. Epithelioid histiocytes with multinucleated giant cells and lymphocytes.

abdominal tuberculosis is the ileocecal region. The other organs of the abdomen (liver, spleen, kidney, and pancreas) can also be affected by the disease [5]. Pancreatic tuberculosis, however, is a very rare type of TB that can mimic pancreatic carcinoma. The increase in reported cases of pancreatic TB in the last years can be attributed to improved imaging techniques such as EUS, which can obtain specimens from the pancreatic lesion [6]. EUS images can provide a first impression about the type of tumor, but biopsy is required for the final diagnosis. The clinical symptoms are variable, including abdominal pain, jaundice, fatigue, weight loss, fever, anorexia, peripheral lymphadenopathy and night sweats [7].

Tuberculosis is still a major health problem worldwide, with an estimated of 10 million individuals becoming ill in 2018 [7]. In the same year 1.5 million deaths were reported because of TB. In developing countries, TB is a

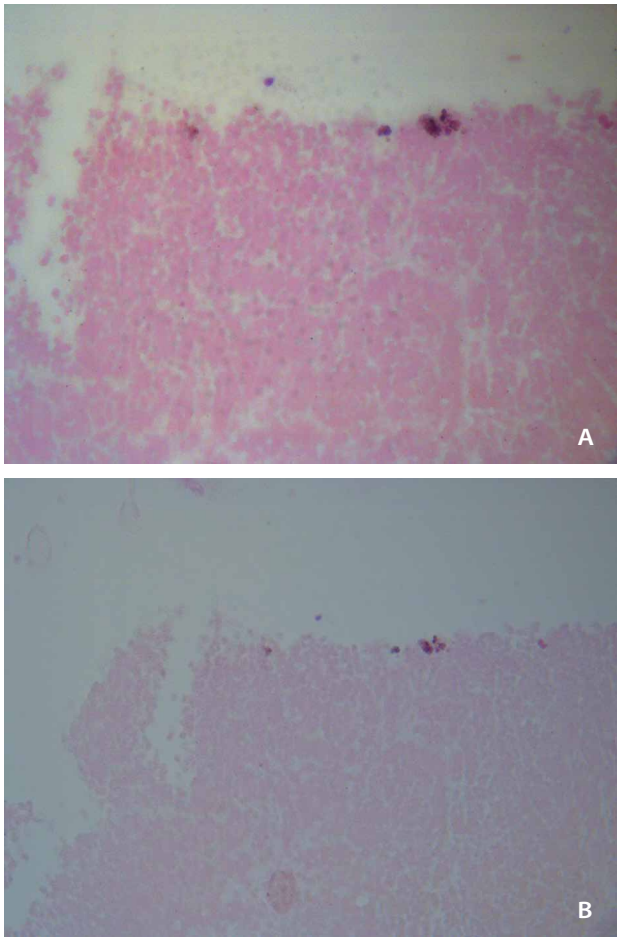

FIGURE 4 A - B. Ziehl-Neelsen stain for Mycobacteria Tuberculosis.

constant problem [8]. The main factors responsible for the erection of the global TB epidemic are due to poverty, Human immunodeficiency Virus (HIV) infection, and drug resistance [8-9].

The most common type of Tuberculosis is pulmonary TB [7]. The bacilli reach the lungs of patient via droplet infection and if the immunity of the body fails to limit the infection, bacterial proliferation occurs inside the alveolar macrophages [7]. These bacilli migrate to other organs. Abdominal TB comprises about 10% of all TB cases which include the GI tract, peritoneum, lymph nodes or solid organs [5,7].

Gastrointestinal Tuberculosis can occur by ingestion of contaminated milk or meat. Infection can occur from adjacent organs or spread can occur via lymphatics. Pancreatic Tb is an extremely rare type of tuberculosis [7]. There are three forms of pancreatic TB that have been reported: miliary TB, spread from retroperitoneal lymph nodes to the pancreas and localized pancreatic TB [10]. The most common symptoms include weight loss (75%), anorexia (69%), fever (50%), jaundice (31%) and abdominal pain (25%). Pancreatic TB can mimic pancreatic carcinoma. The most common site of pancreatic TB is the head of the pancreas (~59%) following body (18%) and tail (13%). Usually, pancreatic TB presents with the form of mass (~80%) [10-11].

The imaging features of pancreatic Tb in CT are solitary parenchymal lesions (head>body), intra/peri-pancreatic collections, pancreatic duct dilatation, enlarged lymph nodes, granulomas in liver/spleen/omentum, ileocecal and peritoneal involvement and ascites. EUS findings include heterogeneous echotexture of the pancreas, and hypoechoic collections may be seen in some cases, peripancreatic lymphadenopathy and ascites [12].

Fine Needle Biopsy through EUS gives us the ability to obtain specimen from the pancreatic lesion, so the diagnosis is made soon enough to avoid further dilemmas. The diagnostic accuracy of EUS-FNA/FNB in pancreatic TB is difficult to determine due to the rarity of this entity [11]. It has been reported that the success rate of EUS-FNA/FNB for pancreatic TB ranging from 50-62% [10-11]. The pathology test confirms the diagnosis [13]. The common pathology findings are granulomas, inflammatory cells comprising neutrophils, lymphocytes and macrophages. The Ziehl-Neelsen stain for Acid-Fast Bacilli (AFB) showed positive results indicating presence of AFB [12-14].

The gold standard of treatment of Pancreatic TB includes anti-tubercular drugs. The duration of treatment is six months. The drugs administrated include Rifampicin (10mg/kg/day), Isoniazid (5mg/kg/day) Ethambutol (20mg/kg/day) and Pyrazinamide (30mg/kg/day). Conventional anti-tubercular treatment is adequate for Pancreatic tuberculosis that usually retreats completely [15]. Our patient received the standard quadruple therapy (Rifampicin, Isoniazid, Ethambutol, Pyrazinamide) and after 6 months he responded completely.

CONCLUSION

Pancreatic tuberculosis is a very rare form of abdominal TB, which still exists even in countries, like Greece, that was eliminated. This is a result of the migration from epidemic regions of TB. It is important to know that a pancreatic tumor is not always carcinoma. The symptoms are not specific and high levels of suspicion are needed to do the diagnosis. CT is important but the final diagnosis depends on pathology examination of the specimen we obtain through EUS-FNB. Conventional anti-tubercular treatment usually achieves complete response.

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Funding: *None.*

Ethical standards: *Patient consent to publish this manuscript.*

Conflict of interest: *None to declare.*

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Case Report

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Metastasis from gastric cancer presenting as a rectal lesion: A Rare Case Report

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ABSTRACT

Introduction: Liver, lymph node, lung and peritoneal metastases are the most common sites of the metastatic sites of gastric cancer. Isolated rectal metastasis of gastric cancer is one of the rare metastases observed in case reports in the literature.

Case Report: A 58-year-old male patient was admitted to the outpatient clinic with dyspeptic symptoms. Gastroscopy revealed a mass approximately 5 cm in diameter on the lesser curvature of the stomach. Surgery was planned as no distant metastasis was observed on abdominal tomography. The patient underwent total gastrectomy and the histopathology report of D2 lymph node dissection was consistent with T4aN3a adenocarcinoma. During adjuvant treatment, the patient was admitted to the emergency room with ileus symptoms three months after surgery. The patient underwent emergency surgery and no signs of peritoneal or distant metastasis were detected during exploration. Low anterior resection was performed as a mass was detected in the rectum. The histopathology report was of rectal metastasis of gastric cancer, and the patient was discharged without any complications.

Conclusion: Isolated rectal metastasis of gastric cancer is a rare condition and should be kept in mind when patients who have undergone surgery for gastric cancer present with ileus symptoms. Rectal metastasis may cause ileus by creating a mass effect or may negatively affect the patient's surveillance because it is considered a distant metastasis.

Key Words: *Gastric cancer; rectal metastasis; ileus*

INTRODUCTION

Gastric cancer is the fifth most common type of cancer worldwide and ranks third among causes of cancer-related deaths after lung cancer and colorectal cancer [1]. Patients with advanced gastric cancer often develop distant metastases, particularly liver, peritoneum, lung, and bone metastases. Rectal metastases are relatively rare and there is currently a lack of relevant clinical reports [2]. The case herein presented is of a patient who underwent surgery for gastric cancer and developed ileus symptoms due to isolated rectal metastasis in the postoperative period. The aim of this study is to keep in mind the possibility of rectal metastasis in gastric cancer patients if there are signs of constipation and intestinal obstruction.

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Case Report

A 58-year-old male patient presented at the outpatient clinic with dyspeptic complaints. The patient had complaints of dyspepsia and upper gastrointestinal pain that had been ongoing for approximately five months. In the upper gastrointestinal system endoscopy, an ulcer

with irregular borders, fragile to touch and malignant appearance was observed, which extended towards the greater curvature towards the proximal posterior wall of the corpus and the middle of the corpus. The histopathology report was evaluated as adenocarcinoma. Since no distant metastasis was observed on thoracoabdominal computed tomography (Figure 1), the decision to operate was made. Colonoscopy was not planned because the patient had no signs of constipation. Preoperative hemoglobin value was 12.9 g/dL and albumin value was 39.9 g/L. The patient received 4 cycles of chemotherapy with the FLOT regimen before surgery and 4 cycles after surgery. Subsequently, the patient underwent total gastrectomy, roux-n-y esophagojejunostomy and D2 lymph node dissection due to gastric cancer. The histopathology report was evaluated as gastric adenocarcinoma (T4aN3a) and intestinal type adenocarcinoma. There was no tumour in the surgical margins in histopathology. In histopathology report 36 lymph nodes were harvested and there was metastasis in nine lymph nodes. No postoperative complications developed and the patient was discharged on the 7th postoperative day. At three months after the surgery, the patient, who had no additional pathology, was admitted to the emergency room with ileus findings. On physical examination, there was widespread abdominal distension. Abdominal tomography showed widespread dilatation and air-fluid levels in the bowel loops. The patient underwent emergency surgery. During exploration, a mass lesion was observed in the proximal rectum, completely obstructing the lumen. There was no peritoneal carcinomatosis. Low anterior resection and loop ileostomy were performed. No postoperative complications were observed and the patient was discharged on the seventh postoperative day. The histopathology report of the case was evaluated as rectal metastasis of gastric cancer. The patient subsequently received adjuvant chemotherapy. The patient died four months after the second surgery due to poor general condition.

FIGURE 1. CT of the patient.

DISCUSSION

Metastases to the gastrointestinal system are rare. Overall, the incidence of metastases to the upper and lower gastrointestinal tract is 0.03% and 0.05% of all metastatic sites, respectively. In the limited literature available on this subject, gastrointestinal metastases are mostly treated as a single group. However, management, treatment, and prognosis vary significantly depending on the metastatic site and the underlying primary tumour [3].

Recurrence of gastric cancer can present in a variety of ways and a high index of suspicion should be present. There are case reports describing the first symptoms of gastric adenocarcinoma as large bowel obstructions, suggesting that this malignancy is often diagnosed late and has an insidious nature. Well-defined routes of metastases after curative resection of gastric adenocarcinoma are lymphatics, peritoneal seeding, hematogenous spread, or local recurrence [4]. Lymph node metastasis is common both at the time of initial diagnosis of gastric cancer and at the time of diagnosis of metastases. However, only one article has reported metastasis to the rectum without any lymph node metastasis at the time of diagnosis of primary gastric cancer or at the time of occurrence of rectal metastasis [5,6]. Intestinal metastases from gastric cancer spread from the gastrocolic and mesenteric ligaments but are very rare and most cases are detected in postmortem studies. Rectal metastases in gastric adenocarcinomas have been reported in the literature. In those cases, intestinal metastases of poorly differentiated diffuse signet ring cell type gastric adenocarcinomas were detected and surgical treatment and/or chemotherapy were performed [7]. In a case report by Uemura et al., it was observed that early-stage gastric cancer metastasised to the rectum, and no metastases were observed in the abdomen or other solid organs. That study led to the thought that gastric cancer rectal metastasis occurs via hematogenous transmission [8]. In a study by Song et al., isolated cecum and rectum metastasis of gastric cancer was observed [9]. In the current case, moderately differentiated adenocarcinoma was

observed, signet ring cells were not seen, and only lymph node metastasis was observed.

In conclusion, isolated rectal metastasis of gastric cancer is a very rare condition. It should be considered in patients presenting with constipation, intestinal obstruction findings and rectal bleeding. In cases with signs of constipation and intestinal obstruction, colonoscopy must be performed during treatment planning. Since rectal metastasis is considered distant metastasis, the prognosis remains poor.

Conflict of interest: *All authors confirms that they have no conflicts of interest.*

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Caustic sclerosing cholangitis following surgical management of hepatic hydatid cysts

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ABSTRACT

Introduction: Caustic sclerosing cholangitis represents a rare postoperative complication occurring after surgical treatment of liver hydatid cyst. It has been hypothetically attributed to the caustic effect of the scolicidal agent injected into the cyst for sterilisation, subsequently diffusing into the biliary tree through a cysto-biliary fistula.
Materials and Methods: We present a case series of 3 patients with caustic sclerosing cholangitis, observed following surgical treatment of liver hydatid cysts among 268 patients. Sterilisation of cyst content was performed using intracystic injection of 2% formalin solution in 2 cases. Caustic sclerosing cholangitis was diagnosed at 2, 3, and 7 months post-surgery by retention jaundice caused by irregular strictures of intra- and/or extra-hepatic bile ducts. Following hydatid cyst treatment, all 3 cases died, respectively, 2, 4, and 6 years after the intervention. Patients died from secondary biliary cirrhosis and 1 patient died from septic shock. Despite its relative rarity (3/268 of cases in our study), the severity of this iatrogenic complication and the unproven efficacy of cyst sterilisation maneuvers have discouraged us for years from using the intracystic injection of scolicidal solution technique for hydatid cyst sterilisation.
Discussion: Caustic sclerosing cholangitis progresses rapidly and is generally devoid of effective treatment, subsequently leading to the development of secondary biliary cirrhosis, or even cholangiocarcinoma.
Conclusion: Caustic sclerosing cholangitis is a rare and serious iatrogenic complication questioning the safety of intracystic sterilisation. Mechanical protection, combined with preoperative albendazole treatment, appears to be an effective alternative to avoid this complication.

Key Words: *Case series; caustic sclerosing cholangitis; liver hydatid cyst; scolicidal agents*

INTRODUCTION

Liver hydatid cyst (LHC) remains a significant endemic problem in Morocco and in many countries worldwide. Surgical treatment includes closed or open pericystectomy and excision of the protruding dome (EPD). Traditionally, cyst evacuation and sterilisation using scolicidal solutions were performed to eliminate viable cyst elements and prevent intra-abdominal dissemination. However, current guidelines do not mandate the use of scolicidal agents; instead, they emphasise careful protection of the surgical cavity to avoid spillage [1].

Various scolicidal agents, including hypertonic saline, formaldehyde, anhydrous ethanol, and hydrogen peroxide (H_2O_2), may cause caustic injury if they enter the biliary tree, particularly in the presence of cysto-biliary communication (5–10% of cases) [2,3]. This can lead to hepatic stasis, edema, tissue necrosis, and histopathological changes—characteristic of caustic sclerosing cholangitis (CSC). For this reason, the use of scolicidal solutions is now largely discouraged.

Herein, we present a case series of 3 patients who

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developed CSC following surgical treatment of LHC. These cases were identified among 268 patients operated between 1998 and 2005. This report highlights the diagnostic and therapeutic challenges posed by CSC and discusses preventive measures, including the modern emphasis on avoiding scolicidal agents.

CASE PRESENTATION

This is a retrospective case series of 268 patients who underwent surgical treatment for LHC in our department between January 1998 and December 2005. Inclusion criteria were all patients with one or more LHC treated surgically during this period, with available operative records and follow-up data. Patients without adequate documentation or who were lost to follow-up immediately after surgery were excluded. Follow-up was conducted through a combination of active methods (scheduled outpatient visits and telephone contact) and passive review of hospital medical records. Complications and deaths were identified through hospital readmissions, endoscopic or radiological findings, and official death certificates when available. The median follow-up for the cohort was 20 years (range: 18–25 years).

The patients ranged from 16 to 78 years old, with an average age of 45 years. The LHC was classified as CE1 stage without cysto-biliary fistula (CBF) in 61 cases (23%), CE2, CE3, CE4, and CE5 stages with a minor CB Fin 186 cases and a major CBF in 21 cases [5]. Surgical treatment was performed for all cases. Sterilisation of the cyst content was performed in 73 cases by directly introducing 20-30 cc of hydatid fluid and 10-30 cc of 2% formalin solution into the decompressed cyst. After evacuation of the cyst content, residual cavity treatment was carried out by EPD in 251 cases, total pericystectomy in 6 cases, and subtotal pericystectomy in 11 cases. In cases of existing CBF, intraoperative cholangiography (IOC) was systematically performed.

Three patients developed CSC at 2, 3, and 7 months postoperatively (Table 1). The diagnosis was established based on the following criteria: (i) a history of previous surgery for LHC with documented intracystic injection of scolicidal agents; (ii) early postoperative onset of progressive obstructive jaundice; (iii) normal biliary tract appearance during the initial surgery and on intraoperative cholangiography (IOC), excluding preexisting bile duct narrowing; (iv) cholangiographic evidence (ERCP or percutaneous cholangiography) of new multifocal or segmental biliary strictures consistent with sclerosing cholangitis (Figure 1); and (v) exclusion of other potential causes such as iatrogenic bile duct injury (no intraoperative injury identified), primary sclerosing cholangitis (PSC) (no diffuse inflammatory involvement or extrahepatic association), and neoplastic strictures (no mass lesion on imaging or histology). These criteria are consistent with those described by Belghiti et al. and subsequent reports.

In all 3 cases, CSC evolved insidiously, progressing to SBC characterised by chronic cholestasis, portal hypertension, and recurrent cholangitis. The disease followed a relentless course, with fatal outcomes in all patients between 2 and 6 years postoperatively, despite repeated biliary drainage and supportive management. None were successfully evaluated for liver transplantation due to rapid progression and associated comorbidities.

CLINICAL DISCUSSION

Caustic sclerosing cholangitis (CSC), as termed by Belghiti et al. [3], is a rare form of secondary sclerosing cholangitis (SSC), less commonly seen in clinical practice. Unlike primary sclerosing cholangitis (PSC), CSC progresses rapidly, and its prognosis is more unfavorable. It is localised to only a part of the biliary tree, unlike PSC where the entire tree is affected [6].

Various experimental studies have examined the effects of 95% alcohol, 10% povidone iodine, 0.9% - 5% - 10% - 20% NaCl, 3% H2O2, 5% formalin, 0.5% silver nitrate, and cetrimide on the liver and biliary tree. Serious hepatobiliary complications have been reported for formalin, alcohol, and 10%-20% NaCl [7,8]. K. W. Warren et al. [9] reported

TABLE 1. Structured Case Summaries.

Case	Year	Age/ Sex	Scolicidal Agent	Major CBF	Timing of CSC Diagnosis	Initial Surgery	Key CholangiographicFindings	Final Outcome
1	1999	48/M	2% Formalin (20 cc)	Yes	2 months	EPD	Diffuse intra- and extrahepatic strictures	Progressed to SBC; death from variceal bleeding (2 yrs)
2	2002	52/F	2% Formalin (25 cc)	Yes	3 months	EPD	Irregular stenosis of CBD and biliary convergence	Progressed to SBC; death from septic shock (4 yrs)
3	2004	44/M	Hypertonic saline (30 cc)	Yes	7 months	EPD	Localised circular stenosis of middle CBD	Progressed to SBC; death from variceal bleeding (6 yrs)

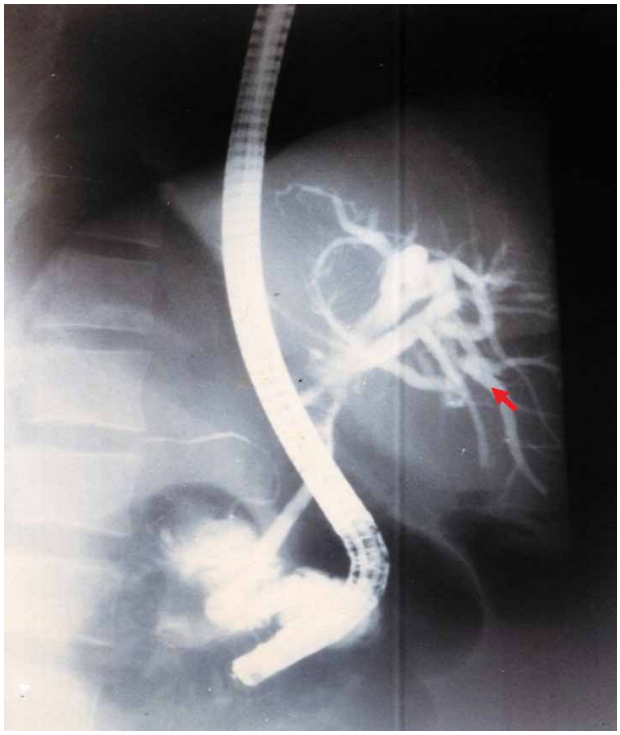

FIGURE 1. Endoscopic retrograde cholangiopancreatography (ERCP) showing stenosis of the bile duct convergence (arrow).

in 1966 in their study of 42 cases of sclerosing cholangitis the first case of CSC. The pathogenic effect of scolicidal products on the biliary mucosa is now well-known experimentally; indeed, in all reported cases, a CBF was present, allowing the passage of scolicidal solution into the bile duct tract, thus exposing the mucosa to chemical aggression. In all reported cases, the bile duct tract was normal at the time of primary surgery; sclerosing lesions developed rapidly afterward, affecting both the intrahepatic and extrahepatic bile ducts. In the present study, the 3 observed cases of CSC were presented with direct injection into the cyst after aspiration of 20 to 30 cc of hydatid fluid corresponding to the volume of scolicidal solution injected. Absence of bile duct lesions was observed, and cholangitis lesions developed rapidly without infectious episodes (Figure 2). In most reported cases, 2% formalin solution was the incriminated scolicidal solution in the development of sclerotic lesions. However, hypertonic solutions may also be responsible for CSC.

Houry et al. [10] demonstrated in their experimental study that direct injection of 20% hypertonic saline solution and 0.5% formaldehyde solution into the biliary tree induced histopathological changes in the biliary tree epithelium, including focal hepatocyte necrosis, sinusoidal flattening, Kupffer cell hyperplasia, regenerative changes in hepatocytes, fibroblastic proliferation, and necrosis

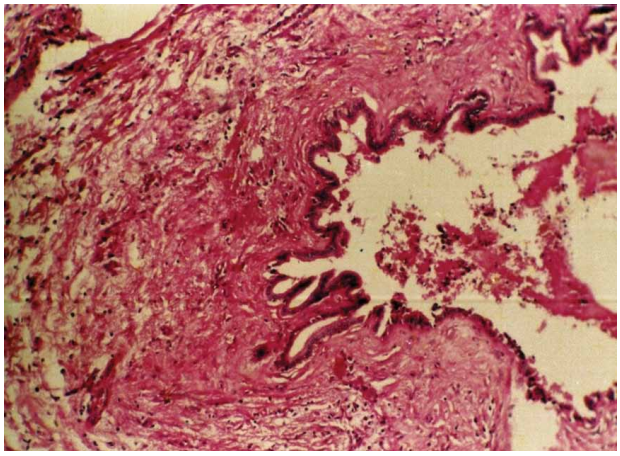

FIGURE 2. Microscopic view of a liver biopsy showing features of sclerosing cholangitis.

in the extrahepatic bile ducts [11]. These lesions were interpreted as an early stage of CSC. 2% formaldehyde solution, corresponding to the concentration used to sterilise human hydatid cysts, caused sclerosing cholangitis in most rats and pseudocirrhosis in some of them 3 months after injection into the biliary tree [10]. Caustic damage to the epithelium of the communicating bile ducts has also been reported when using silver nitrate as a scolicidal agent [12]. The pathogenesis of these lesions remains speculative. The lesions could be due to infectious, vascular, chemical, or immunological factors; this could explain their late development and, in some cases, their development in areas distant from those presumed to be directly exposed to formaldehyde solution [13]. After evaluating the side effects on the hepatobiliary system and in vivo activity, Kilicoglu et al. [14] concluded in their experimental study that 10% diluted honey could be used as a potential scolicidal agent.

Several fundamental factors are thought to contribute to the development of CSC [11,15]. The disease arises when a scolicidal agent is injected into the cyst cavity in the presence of a cysto-biliary communication, allowing the solution to enter the biliary tract. Prolonged exposure of the bile ducts to the scolicidal agent further aggravates the chemical injury, and individual sensitivity to the agent may amplify tissue damage once contact occurs.

The key diagnostic points of CSC have been well described in the literature [3,16]. A typical history involves previous surgery for LHCs with the use of chemical agents aimed at destroying the scolex or damaging the cyst wall. Importantly, the bile ducts usually appear normal before and during the operation, and the subsequent development of lesions is related to the presence of a cysto-biliary communication, to adhesions, or to a new communication

that appears after excision of the cyst. Clinically, patients present with recurrent episodes of biliary obstruction and infection, most often characterised by obstructive jaundice at an early stage, which may progress to a mixed form in advanced disease. Imaging, particularly MRCP, typically reveals localised bile duct stenosis with dilatation of intrahepatic bile ducts, although distal bile duct stenosis is rare. Liver function is frequently impaired, often reaching Child-Pugh class B or C. Histopathological evaluation of bile duct biopsies generally demonstrates a chronic inflammatory reaction. Finally, the diagnosis requires careful exclusion of other causes of obstructive biliary disease, such as PSC, iatrogenic BDI, or neoplastic strictures.

Symptoms of CSC are similar to those of PSC and manifest as progressive jaundice, which is often confused with iatrogenic biliary trauma and biliary obstruction caused by scolex fragments, with a rapidly increasing GGT level within seven days, followed by a progressive increase in BT and PAL levels. Ultrasound (US), computed tomography (CT), or endoscopic US may show suggestive anomalies and allow the exclusion of other causes of cholestatic jaundice. However, the normality of these examinations does not exclude the diagnosis of CSC. The reference examination is direct bile duct opacification, by transhepatic puncture or preferably by ERCP. Anatomically, several patterns of lesions have been described in CSC. One common feature is the alternation of stenotic and dilated zones, producing a characteristic mound-like appearance. In other cases, diffuse segmental stenoses are observed, or alternating stenoses with non-stenotic peripheral segments. The involvement of peripheral bile ducts may result in a marked reduction of bile tree branching, creating the so-called "*dead tree*" appearance. In addition, a stenotic narrowing at the level of the main bile duct can be associated with sacculated or ampullary dilatation of the proximal intrahepatic bile ducts.

A classification of stages of increasing severity is schematised by Li-Yeng and Goldberg [17]. The main goal of treatment is to relieve biliary obstruction, alleviate symptoms, and improve survival and quality of life for these patients. Medical treatment includes long-term use of ursodeoxycholic acid, which eliminates endogenous bile acids and protects hepatocytes and biliary epithelial cells. Concurrent use of ursodeoxycholic acid during biliary obstruction relief may accelerate cholestasis regression [18]. Corticosteroids and immunosuppressants are often used to reduce jaundice, owing to their anti-inflammatory and immunological properties, allowing tissue damage reduction.

Sezer et al. [19] suggested that melatonin may effectively improve the prognosis of patients with CSC, but this still requires clinical confirmation. In case of angiocholitis, medical treatment is limited to antibiotic therapy and parenteral administration of vitamin K. ERCP is an effective means of improving biliary stasis, offering significant benefits in terms of therapeutic efficacy and low adverse effects. Biliary stent placement, in particular, can effectively restore enterohepatic bile circulation, often constituting the main treatment for CSC [20]. Cameron and Gayler [21] proposed resection of the extrahepatic bile duct up to the intrahepatic bile duct convergence where stenosis is predominant and performing bilioenteric anastomosis on a Y-loop.

All these strategies aim to relieve symptoms in a palliative manner but have no impact on CSC progression. Morali [22] reported a case of a 16-year-old girl operated on for a LHC using 2% formaldehyde. She developed CSC immediately postoperatively, treated with ERCP and antibiotic therapy, and after a year she developed SSC, then she ended up being transplanted after 4 years. Liver transplantation remains the only potential cure, but its implementation must strictly adhere to indications.

The prognosis of CSC is severe due to rapid progression to PSC and portal hypertension syndrome as well as associated complications [3]. Death occurs within less than 5 years after the first clinical signs in the absence of liver transplantation [3,23]. Importantly, contemporary WHO and experts now places greater emphasis on prevention of spillage and protection of the surgical cavity, and does not mandate intracystic injection of scolicidal solutions; perioperative benzimidazole therapy (e.g., albendazole) and meticulous surgical techniques to avoid cysto-biliary contamination are recommended as safer strategies. Given the balance between potential benefits and the proven risk of BDI, many centers now avoid intracystic injection altogether, preferring containment with antiparasitic therapy or non-injectable topical methods when sterilisation is required [24]. These more conservative, guideline-informed approaches aim to minimise the rare but catastrophic complication of CSC while still addressing the parasitic risk [25].

Our study adds to the existing literature by providing one of the few documented case series of CSC following surgical treatment of LHCs. Unlike previous reports that have often described isolated cases, our work highlights 3 fatal outcomes within a well-defined surgical cohort, thereby illustrating the frequency, clinical course, and lethality of this complication in an endemic setting. By situating these cases within a retrospective series of 268 operated patients, we emphasise not only the direct link between scolicidal agent use and subsequent biliary injury

but also the importance of contemporary surgical practice, which now discourages intracystic instillation of caustic solutions. Furthermore, we underline the lack of effective curative treatment short of liver transplantation, thereby stressing the critical need for prevention. This case series thus provides practical insights into diagnosis, follow-up, and prevention strategies, complementing previous isolated case descriptions and reinforcing current guideline recommendations against the use of scolicidal agents.

CONCLUSION

The occurrence of caustic sclerosing cholangitis (CSC) underscores the serious risks associated with the intracystic injection of scolicidal solutions during liver hydatid cyst (LHC) surgery. The practice of injecting formalin or other caustic agents into the cyst cavity has no proven benefit in preventing intraperitoneal dissemination and carries a significant potential for irreversible biliary injury when a cysto-biliary communication is present. Accordingly, this technique has been completely abandoned in our current surgical practice.

Prevention remains the cornerstone of management. Strict adherence to safe surgical principles meticulous isolation of the operative field, careful management of any cysto-biliary communication, and avoidance of intracystic injection is essential. When sterilisation of the cyst cavity is required, gentle mechanical evacuation and cleansing of the endocyst using compresses soaked in a diluted scolicidal solution under continuous suction provide effective local control while minimising risk. Perioperative benzimidazole therapy and compliance with WHO-endorsed treatment strategies further reduce recurrence and ensure patient safety.

These findings highlight a critical clinical message: the prevention of CSC depends on eliminating the use of caustic intracystic agents and adopting modern, conservative, and evidence-based techniques for hydatid cyst management.

Declarations

Ethical approval and consent to participate: *This study received ethical approval from the General Surgery Department of Ibn Sina University Hospital Ethics Committee.*

Consent to participate: *Informed consent was obtained from all the participants involved in the study.*

Consent for publication: *Not applicable.*

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Registration of Research: *N/A.*

Clinical trial number: *N/A.*

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