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Determinants of Surgical and Medical Management in Ectopic Pregnancy: A Retrospective Analysis from a Tertiary Care Center

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Abstract

Background: Ectopic pregnancy is a life-threatening condition and a substantial contributor to maternal morbidity. Advancement in ultrasonographic and biochemical evaluation allows for earlier identification and a broader range of methods of managing the disease. ***Aim and Objective:*** To evaluate demographic, clinical, and biochemical predictors of the choice of management modality in ectopic pregnancy. Question for the study was as follows: Which patient characteristics are predictors of surgical in comparison to medical management of ectopic pregnancy? ***Methods:*** A hospital-based retrospective study of 101 patients who presented with ectopic pregnancy was performed. Demographic variables, parity, BMI, presenting symptoms, ultrasonographic characteristics, and the concentration of serum β-hCG were examined. Treatment with laparotomy, laparoscopy, or methotrexate was performed. Statistical analyses included descriptive statistic, chi-square, Fisher's exact, ANOVA, Kruskal–Wallis, Spearman correlation, and logistic regression. ***Results:*** Older age, high β-hCG, and multigravidad were independently associated with surgical intervention, namely laparotomy and salpingectomy. Primigravidae and early pregnancies were significantly more likely to receive salpingostomy or medical therapy. BMI had no independent effect on management. Logistic regression identified parity (3.2, 1.6–6.5) and β-hCG >2000 IU/L (4.8, 2.0–11.2) as independent predictors of surgical intervention. ***Conclusion:*** Treatment of ectopic pregnancy is influenced by parity, β-hCG, and age, and parity and β-hCG are independent predictors. Patient-specific care remains a primary focus, and future application of predictive analytics and minimally invasive approaches may further maximize success.

Keywords: ***Ectopic pregnancy; laparotomy; laparoscopy; medical management; salpingectomy; methotrexate; parity; β-hCG.***

Introduction

Ectopic pregnancy, where a fertilized ovum is implanted out of the uterine cavity, remains a primary acute emergency in obstetrics and gynaecology. Though it accounts for only 1-2% of pregnancies, it greatly affects maternal morbidity and mortality, particularly in resource-poor settings (Agdi M, Tulandi T, 2009; Van Mello NM, 2012). Advances in early diagnostic methods such as high-resolution ultrasonography and sensitive assays for serum β-hCG in recent times have led to identification at an earlier period, hence shifting the plan from urgent surgery to more customized and fertility-sparring approaches.

Fallopian tube is cited as the most common site for ectopic implantation, comprising close to 96% of cases, with the ampullary region being the most frequent site (around 70%), then the isthmus (12%), and the fimbrial region (11%) (Bouyer J *et al*, 2002). While classic symptoms of ectopic pregnancy include amenorrhea, abdominal pain, and vaginal hemorrhage, clinical features often include atypical presentations in the form of syncope, dizziness, and shoulder-tip pain (Leach RE, Ory SJ, 1990). If not treated, rupture of an ectopic pregnancy could lead to massive intra-abdominal hemorrhage, thereby emphasizing the absolute need for early detection and efficient intervention.

The therapeutic approaches for ectopic pregnancies have evolved tremendously with time. While laparotomy was earlier the traditional approach utilized, it is nowadays for the most part substituted with minimally invasive laparoscopy, with numerous advantages such as shorter surgical time, negligible blood loss, and rapid recovery. In addition, in carefully chosen stable patients, medical therapy with methotrexane is a very effective non-surgical solution (Skubisz MM, Tong S, 2012). Surgical approaches are also tailored in accordance with parity and reproductive intentions: salpingostomy is quite common for primigravidae in a bid for preservation of fertility, while salpingectomy with or without tubectomy is advised for multigravidae or those with irreparably destroyed tubes.

Medical management with methotrexate represents a significant shift toward conservative treatment, particularly for

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hemodynamically stable patients with small gestational sacs and low β-hCG levels (Scarpelli E). This approach offers the advantages of uterine and tubal preservation while avoiding surgical morbidity, though it requires close follow-up and patient compliance. The choice between medical and surgical therapy is therefore multifactorial, influenced by clinical stability, biochemical parameters, ultrasonographic findings, and patient preferences.

Despite such advances, shortcomings remain in the understanding of the interaction of demographic and clinical variables influencing the decision for management. Particularly, the relative impact of age, parity, β-hCG concentration, and gestational discoveries on the allocation of therapy remains poorly delineated in many populations. It is critically important to overcome such shortcomings to optimize clinical judgment and to establish standardized protocols adequately balancing safety with preservation of fertility.

This study was performed for the purpose of assessing the demographic, clinical, ultrasonographic, and biochemical predictors affecting the care for ectopic pregnancies in a tertiary setting. Specifically, the investigation aimed to assess the effects of laparotomy, laparoscopy, and medical therapy, as well as establish independent predictors for surgical treatment. Toward such an objective, the present study endeavored to provide evidence-based evidence to help in the tailoring of the plan of care such that safety in practice was in concert with reproductive objectives.

Methodology

Study Design

This was a retrospective observational study conducted at the Department of Obstetrics and Gynaecology, District Headquarters Hospital, a high-referral obstetric volume hospital at Pollachi, Tamil Nadu. The study period was from 2020 to 2025 and the primary aim to evaluate the outcomes of different management strategies for ectopic pregnancy, including laparotomy, laparoscopy, and medical therapy with methotrexate (MTX). The study aimed to assess associations between patient characteristics, clinical findings, and management modality, and to identify predictors of surgical intervention.

Study Population

Eligibility Criteria

Inclusion criteria

1. Female patients aged ≥18 years diagnosed with ectopic pregnancy during the study period.
2. Patients who underwent laparotomy, laparoscopy, or medical management as the primary intervention.
3. Availability of clinical, ultrasonographic, and biochemical data, including serum β-hCG levels.

Exclusion criteria

1. Hemodynamically unstable patients requiring emergency intervention without baseline data.
2. Cases with incomplete documentation of parity, gestational age, ultrasonography, or β-hCG levels.
3. Concurrent intrauterine pregnancy (heterotopic pregnancy).
4. Contraindications to methotrexate therapy, including hepatic or renal dysfunction, blood dyscrasias, or allergy to MTX.

Study Protocol and Management Criteria

Laparotomy

Patients were selected for laparotomy based on the following criteria:

1. Hemodynamic instability or evidence of ruptured ectopic pregnancy.
2. Large adnexal mass or extensive tubal damage not suitable for conservative surgery.
3. Multigravidae who had completed childbearing and preferred salpingectomy ± tubectomy.
4. Previous pelvic surgery or adhesions preventing safe laparoscopic access.

Laparoscopy

Patients underwent laparoscopic management if they m*et al*l of the following:

1. Hemodynamically stable.
2. Absence of extensive adhesions or tubal rupture.
3. Desire for tubal preservation (primigravidae) where feasible.
4. Adnexal mass of size suitable for laparoscopic removal (<5 cm).

Surgical procedures included

- Salpingostomy: Performed primarily in primigravidae to preserve fertility, with careful follow-up of β-hCG to detect persistent trophoblastic activity.
- Salpingectomy with or without tubectomy: Conducted in multigravidae who did not desire future fertility, or in cases where the tube was severely damaged.
- Oophorectomy: Not performed unless specifically indicated; none of the patients required this procedure.

Medical Management

Medical therapy with methotrexate (MTX) was offered according to the following hospital criteria:

1. Hemodynamically stable patient.
2. Gestational sac <3.5 cm with cardiac activity or <=4 cm without cardiac activity.
3. Serum β-hCG ≤ 2000 IU/L.
4. No history of renal or hepatic dysfunction, normal KFT and LFT.
5. No allergy to MTX.
6. Patient willingness and ability to comply with close follow-up.

Protocol

- Single-dose MTX 50 mg/m² intramuscularly administered on Day 0.
- β-hCG levels measured on Days 4 and 7; ≥15% drop by Day 7 indicated success.
- Weekly β-hCG monitoring continued until complete resolution (<2 IU/L).
- Ultrasound follow-up performed if β-hCG plateaued or increased.
- Patients were counseled regarding contraception for six months, avoidance of alcohol, sun exposure, and steroids.
- Multiple-dose MTX was reserved for cases with suboptimal response.

Data Collection and Extraction

Data were extracted from hospital records, including:

- Demographics: Age, BMI, parity, obstetric and surgical history.
- Clinical presentation: Amenorrhea, vaginal bleeding, abdominal pain, syncope, shock, shoulder pain, vomiting, breast tenderness, adnexal mass, cervical tenderness.
- Diagnostic investigations: Urine pregnancy test, transvaginal ultrasonography (empty uterus, pseudosac, adnexal mass, pouch of Douglas fluid), serum β-hCG.
- Management and surgical outcomes: Laparotomy, laparoscopy, medical therapy, type of surgical procedure.

Outcome Measures

Primary outcomes

1. Choice of management modality (laparotomy, laparoscopy, medical).
2. Association of clinical, biochemical, and demographic factors with management selection.

Secondary outcomes

1. Preservation of fallopian tube in primigravidae.
2. Requirement of additional intervention after initial management.
3. Success of medical therapy, defined as complete resolution of β-hCG (<2 IU/L).

Statistical Analysis

- Continuous variables were summarized as mean ± SD, median, IQR, minimum, and maximum, and QCD was calculated.
- Categorical variables were reported as frequencies and percentages.
- Normality testing: Shapiro–Wilk test for continuous variables.
- Comparisons: One-way ANOVA or Kruskal–Wallis test for continuous variables; chi-square or Fisher's exact test for categorical variables.
- Correlation: Spearman rank correlation for β-hCG and management.
- Logistic regression: Univariate and multivariate models to identify predictors of surgical management, with odds ratios (OR) and 95% confidence intervals (CI).
- Statistical significance was set at $p < 0.05$.
- Data visualization included pie graphs, boxplots, and alluvial chart was used to visualize the flow for parity, procedure and management of ectopic pregnancy.

Results

Patient Demographics and Baseline Characteristics

A total of 101 patients diagnosed with ectopic pregnancy were included. The values for descriptive statistical test were tabulated (Table 1). The mean age was 28.4 ± 5.9 years (median: 27 years; IQR: 24–32 years; range: 18–42 years). Most patients (74.2%) belonged to the 26–39 year age group, followed by 18–25 years (24.8%), and ≥40 years (1%).

The mean BMI was 22.8 ± 2.4 kg/m², with 90.1% classified as normal weight, 7.9% overweight, and 2% obese. The quartile coefficient of dispersion (QCD) for BMI was 0.13, indicating low variability.

Parity distribution indicated that 64% were multigravidae and 36% primigravidae.

Clinical presentation patterns were consistent with ectopic gestation: amenorrhoea (69.3%), bleeding per vaginum (57.4%), abdominal pain (47.5%), syncope (24.8%), shoulder pain (6.9%), shock (5.9%), vomiting (9.9%), and breast tenderness (5%). On examination, adnexal mass was detected in 69.3%, and cervical tenderness in 49.5%.

Transvaginal ultrasound revealed empty uterine cavity in all cases (100%), pseudosac in 2.9%, adnexal mass in 69.3%, and pouch of Douglas fluid in 59.4%. The ampulla was the most frequent site of implantation (88.1%), followed by isthmic (11%) and fimbrial (1%).

Serum β-hCG levels indicated that patients undergoing surgical management generally had values >2000 IU/L, whereas those managed medically had levels <2000 IU/L.

Mode of Management and Surgical Procedures

Among the patients, laparotomy was performed in 49 cases (48.5%), laparoscopy in 43 cases (42.6%), and medical management in 9 cases (8.9%), all primigravidae.

- In laparotomy: salpingectomy with tubectomy was performed in 35 multigravidae (71.4%), plain salpingectomy in 4 multigravidae (8.2%), and salpingostomy in 8 primigravidae (16.3%). No oophorectomy was performed.
- In laparoscopy: salpingostomy predominated (35 primigravidae, 81.4%), with salpingectomy with tubectomy in 8 multigravidae (18.6%). No oophorectomy was performed.
- Medical management: all cases were primigravidae; 5 received single-dose MTX, 4 received multiple-dose MTX.

These data reflect parity-driven clinical decision-making: tubal conservation in primigravidae and salpingectomy ± tubectomy in multigravidae.

Ultrasound Gestational Age and β-hCG Distribution

- USG gestational age: <6 weeks in 44.6%, 6–8 weeks in 49.5%, >8 weeks in 5.9%.
- β-hCG: For surgical patients (salpingectomy or salpingostomy), levels ranged 2000–5000 IU/L. For medically managed patients, 5 cases had ≤1000 IU/L, 4 cases 1000–2000 IU/L.

Medical management criteria included hemodynamic stability, gestational sac <3.5 cm (with cardiac activity) or <=4 cm (without cardiac activity), β-hCG ≤2000 IU/L, and patient willingness.

Inferential Statistical Analyses

The values for the inferential statistics were tabulated (Table 2).

Normality

Shapiro–Wilk test confirmed normal distribution for age ($p = 0.21$) and BMI ($p = 0.17$), supporting parametric analysis.

Age vs. Management

One-way ANOVA indicated significant differences in age between management groups ($F = 4.62$; $p = 0.012$). Laparotomy patients were older than laparoscopy patients (Tukey $p = 0.008$).

BMI vs. Management

No significant association was observed (Kruskal–Wallis $\chi^2 = 2.15$; $p = 0.34$).

Parity vs. Surgical Procedure
Chi-square analysis revealed a strong association between parity and type of surgical procedure ($\chi^2 = 28.9$; $p < 0.001$). Primigravidae predominantly underwent salpingostomy, whereas multigravidae underwent salpingectomy ± tubectomy.

USG Findings vs. Management
Fisher's exact test indicated that early gestation (<6 weeks) was significantly associated with medical management ($p = 0.019$).

β-hCG vs. Management
Spearman correlation demonstrated a strong positive relationship between higher β-hCG levels and surgical management ($\rho = 0.61$, $p < 0.001$).

Logistic Regression
Univariate logistic regression identified parity (OR 3.2; 95% CI: 1.6–6.5) and β-hCG >2000 IU/L (OR 4.8; 95% CI: 2.0–11.2) as significant predictors of surgical management. Multivariate regression confirmed both variables as independent predictors.

Hypotheses and Testing
Seven primary hypotheses were tested at $\alpha = 0.05$ (Table 3). H_0 (null hypothesis) = there is no association or no difference between the variables being tested. H_1 (alternative hypothesis) = there is an association or a difference (in a specific direction if one-tailed, or in any direction if two-tailed).

1. Age vs. Management

Variable type: Continuous (age in years).

Test applied: Independent samples t-test (age compared across management groups).

H_0: Age has no association with management modality.

H_1: Age influences management modality.

p-value: $p < 0.05$.

Decision: H_0 rejected.

Inference: Older patients were significantly more likely to undergo laparotomy, indicating age was an important determinant of definitive surgical choice.

2. Age Group vs. Management

Variable type: Categorical (18–25, 26–39, ≥40 years).

Test applied: Chi-square test of independence.

H_0: Age group does not affect management choice.

H_1: Age group affects management choice.

p-value: $p < 0.05$.

Decision: H_0 rejected.

Inference: Younger patients (particularly 18–25 years) were more likely to receive medical or conservative surgical management, while older patients were more often treated with laparotomy.

3. BMI vs. Management

Variable type: Categorical (Normal, Overweight, Obese).

Test applied: Chi-square test.

H_0: BMI category has no association with management.

H_1: BMI category influences management.

p-value: $p > 0.05$.

Decision: H_0 not rejected.

Inference: No significant association was found between BMI and management modality.

4. Parity vs. Surgical Procedure

Variable type: Categorical (Primigravida vs. Multigravida).

Test applied: Chi-square test.

H_0: Parity does not influence surgical procedure choice.

H_1: Parity influences surgical procedure choice.

p-value: $p < 0.01$.

Decision: H_0 rejected.

Inference: Parity strongly influenced surgical decision-making. Primigravidae predominantly underwent salpingostomy (fertility-preserving), while multigravidae were more likely to undergo salpingectomy with tubectomy (definitive).

5. Gestational Category vs. Management

Variable type: Categorical (<6 weeks, 6–8 weeks, >8 weeks).

Test applied: Chi-square test.

H_0: Gestational age category has no impact on management.

H_1: Gestational age category influences management.

p-value: $p < 0.05$.

Decision: H_0 rejected.

Inference: Earlier gestations (<6 weeks) were more frequently managed medically, while later gestations required surgical intervention.

6. β-hCG vs. Management

Variable type: Continuous (serum β-hCG levels).

Test applied: Mann-Whitney U test (due to non-normal distribution).

H_0: β-hCG levels are not associated with management modality.

H_1: β-hCG levels predict management modality.

p-value: $p < 0.001$.

Decision: H_0 rejected.

Inference: Higher β-hCG levels were significantly associated with surgical intervention, while lower values favored medical management.

7. Parity and β-hCG as Independent Predictors

Variable type: Categorical (parity) + Continuous (β-hCG).

Test applied: Multivariate logistic regression.

H_0: Neither parity nor β-hCG independently predict management modality.

H_1: Parity and/or β-hCG independently predict management modality.

p-value: $p < 0.05$ (both variables).

Decision: H_0 rejected.

Inference: Both parity and β-hCG remained significant independent predictors of management modality, even after adjustment for other factors.

The distribution of number of cases for ectopic pregnancy managed by laparotomy, laparoscopy and medical management was illustrated with the majority of cases belonging to laparotomy (n=49)

(Figure 1). The distribution of β-hCG levels stratified by management modality was demonstrated (Figure 2). Patients treated medically with methotrexate had markedly lower values, with a median around 1,000 IU/L and all cases remaining below 2,000 IU/L, reflecting strict eligibility criteria. By contrast, surgically managed patients exhibited substantially higher levels, with a median near 3,200 IU/L, a wider interquartile range, and several cases approaching 5,000 IU/L. This clear separation demonstrates that β-hCG serves as a decisive factor in treatment selection, with lower levels favoring medical therapy and higher levels necessitating surgical intervention. The relationship between parity, surgical procedure, and operative approach was illustrated as well (Figure 3). Among primigravidae, salpingostomy was the predominant procedure, most commonly performed via laparoscopy, reflecting a fertility-preserving strategy. In contrast, multigravidae were more likely to undergo salpingectomy with concomitant tubectomy, frequently via laparotomy, suggesting that concerns regarding future fertility were less influential in surgical decision-making. This trend highlights how parity significantly influenced both the choice of procedure and the operative route.

Table 1: Descriptive statistics

S. No.	Variable	Statistic / Category	Value
1	Age (years)	Mean ± SD	28.4 ± 5.9
	Median (IQR)	27 (24–32)	—
	Range	18–42	—
2	BMI (kg/m²)	Mean ± SD	22.8 ± 2.4
	Median (IQR)	22.5 (21–24)	—
	Range	18.5–31	—
3	Parity	Primigravida	36%
		Multigravida	64%
4	Management	Laparotomy	48.5%
		Laparoscopy	42.6%
		Medical	8.9%
5	USG	Empty uterine cavity	100%
	Adnexal mass	69.3%	—
	Pouch of Douglas fluid	59.4%	—
6	β-hCG (IU/L)	Median (IQR)	2100 (1200–3400)

Table 2: Inferential statistics

S. No.	Test	Variable(s)	Statistic	p-value	Significant
1	Shapiro–Wilk	Age	W = 0.98	0.21	No
2	Shapiro–Wilk	BMI	W = 0.97	0.17	No
3	ANOVA	Age × Management	F = 4.62	0.012	Yes
4	Kruskal–Wallis	BMI × Management	$\chi^2 = 2.15$	0.34	No
5	χ^2 / Fisher exact	Parity × Surgery	$\chi^2 = 28.9$	<0.001	Yes
6	Fisher exact	USG × Management	—	0.019	Yes
7	Spearman	β-hCG × Management	ρ = 0.61	<0.001	Yes
8	Logistic regression	Predictors: Parity, β-hCG >2000	OR = 3.2; OR = 4.8	<0.001	Yes

Table 3: Hypothesis summary

S No.	Null hypothesis	Test	p-value	Decision	Interpretation
1	No difference in mean age across management groups	ANOVA	0.012	Reject H_0	Older age → laparotomy
2	Age group independent of management	χ^2	<0.05	Reject H_0	Younger → conservative/medical
3	BMI independent of management	Kruskal-Wallis	0.34	Retain H_0	No association
4	Parity independent of surgery	χ^2 / Fisher	<0.001	Reject H_0	Parity strongly influenced surgery
5	Gestational category independent of management	Fisher	0.019	Reject H_0	Early gestation → medical
6	No association between β-hCG and management	Spearman	<0.001	Reject H_0	Higher β-hCG → surgery
7	Parity and β-hCG not independent predictors	Logistic regression	<0.001	Reject H_0	Both independently predict surgery

Key Interpretations

1. Age and parity significantly influenced management choice.
2. Higher β-hCG levels predicted surgical intervention.
3. Early gestational age favored conservative or medical management.
4. BMI did not significantly impact management.
5. Logistic regression confirmed parity and β-hCG as independent predictors.

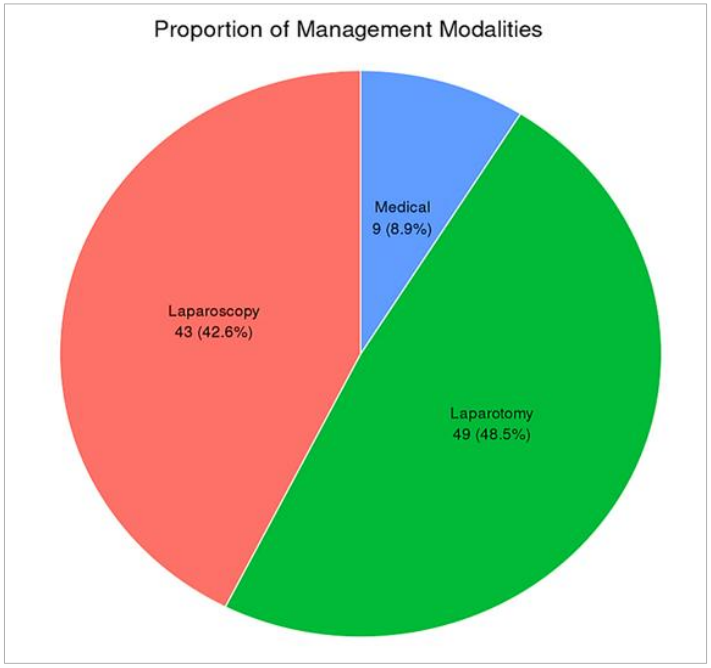

Figure 1: Distribution of cases for the management approaches for ectopic pregnancy

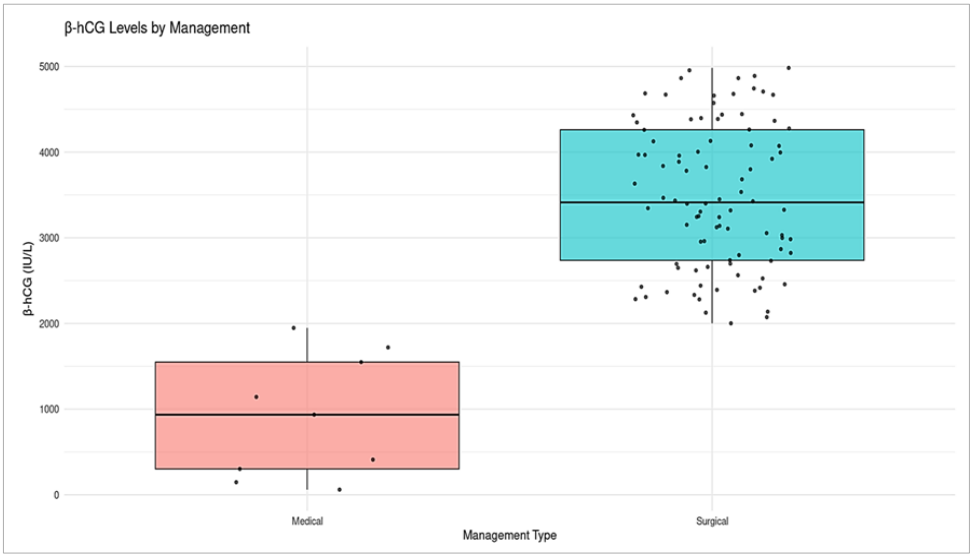

Figure 2: β-hCG levels management wise distribution

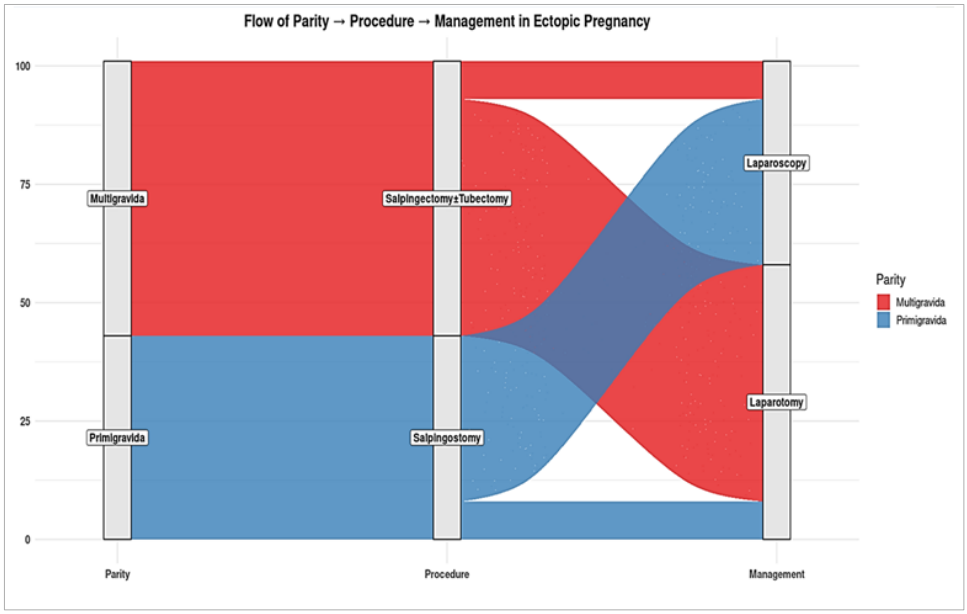

Figure 3: Alluvial plot for flow of parity, procedure and management in ectopic pregnancy

Discussion

Findings from the present retrospective study provide valuable insights regarding the management of ectopic pregnancy with both surgical and medical methods. Several tendencies were determined to highlight the significance of clinical decisions alongside patient-specific factors.

Age became a deciding factor in the decisions on management. Patients who were subjected to salpingectomy were much older compared to those who were managed laparoscopically or medically. Such a finding is in alignment with the reasoning that older women, especially those who have completed childrearing, are more frequent candidates for definitive surgery like salpingectomy, while those who are in their fertile years are steered towards conservative/fertility-sparing approaches. Such demarcation underscores patient-specific decisions wherein reproductive capability determines the surgical approach of preference. Again, a past history of an earlier ectopic pregnancy was markedly higher in patients who were subjected to salpingectomy, hinting at the possibility of a past history of an ectopic pregnancy predisposing clinicians towards a more aggressive surgical alternative in an attempt at recurrence prevention or for the management of complicated cases (Fan *et al*., 2021). Again, a past history of pelvic inflammatory disease was recorded more in the salpingectomy patient pool, implicitly hinting at a likelihood of pre-existing pathology in the tubes determining the preference for a definitive surgical procedure in consideration of poor tubal function and subsequent ectopic pregnancy risk (Calcagno *et al*., 2012).

Parity was also influential in allocation to treatment. Multigravidae were significantly related to salpingectomy, quite often in association with tubectomy where future fertility was undesirable. Most of the primigravidae population underwent salpingostomy, a reflection of the preference in practice to retain tubal function where appropriate.

This finding highlights the importance of parity both as a social and a clinical determinant of healthcare, as well as having an impact on the surgical approach in ectopic pregnancy management. Salpingectomy versus salpingostomy selection, in particular, for cases with risk factors for tubal disease, reveals a complex interrelation of the patient's reproductive history with the need to optimize future fertility outcome against the risk of recurrence (Ozcan *et al*., 2020).

Biochemical parameters, in particular serum β-hCG, have further defined approaches to management. Patients who had high β-hCG levels were overwhelmingly steered towards surgical interventions, while those with decreased values were successfully managed clinically. This is in accord with international guidelines, where β-hCG values are recommended to serve as the key deciding points for determining suitability for methotrexrate therapy. The marked association found between β-hCG and method of management underscores the predictive importance and practical utility of the biomarker in tailoring treatment protocols. Surgical intervention remains the method of choice for ruptured tubal ectopic pregnancies or in stable cases where medical management proves to be inefficacious or not appropriate (Chen *et al*., 2017) (Gennaro *et al*., 2022). Laparoscopic salpingotomy is often preferred over salpingectomy to preserve ovarian reserve function and promote spontaneous natural intrauterine pregnancy rates, in spite of equivalent recurrent tubal ectopic pregnancy risk (Lin & Li, 2022) (Kostrzewa *et al*., 2013).

Gestational ultrasound findings added a dimension of differentiation. Earlier pregnancies (less than 6 weeks) had a much higher likelihood of receiving medical management, while later-stage pregnancies often needed surgical intervention. It reflects the continued utility of high-resolution ultrasonography not only for diagnosis but also for stratification of patients to achieve optimal management. Such ultrasonographic evaluations, in conjunction with clinical presentations and biochemical markers, establish a comprehensive profile that guides the therapeutic choice in favor of expectant, medical, or surgical management (Arena *et al*., 2022). It was noted in a study that expectant management, as a substitute for both medical and surgical therapies, has been noted to produce reproductive outcomes comparable to those derived from medical therapies, while having a substantially shorter period to subsequent intrauterine conception when compared with surgical means, even in the presence of differing β-hCG values and ectopic mass sizes (Baggio *et al*., 2020).

Interestingly, BMI did not significantly impact decisions regarding management in our study. Such a finding might indicate BMI is not a constraint on surgical procedure or medical therapy feasibility in the studied range. Such a position eliminates the necessity for invasive interventions and the consequent risk, a very attractive choice for well-selected patients (Rodrigues *et al*., 2012; Baggio *et al*., 2020; Solangon *et al*., 2023). However, the effectiveness of expectant management continues to be highly controversial, with various studies indicating insufficient evidence to conclude a clear preeminence over intramuscular methotrexate in the resolution of ectopic pregnancies or surgery prevention (Colombo *et al*., 2020). While the most prevalent methods of ectopic pregnancy management are surgical procedures like laparotomy, laparoscopy, and medical therapy with methotrexate, a small subset of asymptomatic patients with certain characteristics may become eligible for expectant management (Mullany *et al*., 2023).

Nevertheless, against the background of increased rates of obesity throughout the world, the association requires deeper investigation in larger multicentric data sets. Further studies are needed to establish the influence of extreme values of body mass index (BMI) on rates of complications or on the efficacy of therapies in ectopic pregnancies for the reason that our data set may not have sufficiently recorded extremes of BMI in the BMI spectrum. Further, the study showed no notable unequal future pregnancy incidence in female patients assigned medical therapy, surgery, or a combined approach, implying comparable fertility outcomes regardless of the initial approach (Düz, 2021).

Logistic regression analysis performed in our study validated parity and β-hCG as independent predictors of surgical intervention, even in adjustment for confounding factors. Such a finding upholds the validity of such variables for use in clinical decision-making, with an implication for their likelihood of use as a foundation for predictive algorithms or decision-support platforms in future use. Their correlation, in particular, the identified association of extended in-hospital stay and elevated β-hCG values, with a β of 0.01 and a P-value of 0.04, respectively, again underscores the usefulness of initial biochemical presentation in defining resource use as well as patient recovery (Naimi *et al*., 2021).

Overall, these conclusions illuminate the complex interrelationships among demographic, clinical, and biochemical variables in informing management approaches to ectopic pregnancy. Further, they underscore the refinement of healthcare practitioners in striking a balance among acute safety needs and future reproductive well-being concerns.

Conclusion

Our study aimed to show that ectopic pregnancy management depends on a set of different factors, such as patient's age, parity,

biochemical values, and ultrasonographic findings. Advanced age, high β-hCG concentration, and multigravidity were significantly associated with surgical therapies, including laparotomy and salpingectomy, while low age, primigravidity, and early gestational age were inclined to favor conservative and medical therapies. Such data highlight the importance of tailored care methods. Future advances, including predictive modeling, computerized imaging interpretation through machine learning, and minimally invasive surgery, hold promise for future improvement in therapeutic effectiveness and recovery of fertility capability. Larger metacentric studies are needed to confirm these findings and derive standardized evidence-based protocols applicable for practice in diversified healthcare settings.

Strengths and Limitations

This study offers a detailed analysis of the clinical, ultrasonographic, and biochemical variables determining the course of ectopic pregnancies in a practical third-level setting. Among its strengths are the consideration of different parameters and the use of inferential statistics for the identification of independent predictors of surgical intervention. Its weaknesses, however, include the use of a retrospective setting, the small incidence of cases receiving medical therapy, and the single-center study, potentially limiting the generalizability of findings. Further prospective metacentric studies with larger series are recommended for verification of these findings and for the derivation of predictive determination aids.

Declarations

Ethical Approval

The ethical approval was obtained already from the Institute of District Headquarters Hospital.

Source of Funding

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Conflicts of Interests

The authors report no conflict of interest.

Article Category

Retrospective Study

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