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Full length article

# Management of tubal ectopic pregnancy in a large maternity unit; a six-year review

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# Keywords: Tubal ectopic pregnancy Methotrexate Surgical management of ectopic pregnancy

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ABSTRACT

*Objective(s)::* Ectopic pregnancy is where a pregnancy develops in an abnormal location. The incidence of ectopic pregnancy in Ireland is approximately 14.8 per 1,000 maternities. Most occur within the fallopian tube and untreated may result in serious morbidity with complications including blood transfusion, visceral injury at surgery and death. Ectopic pregnancy remains the leading cause of death worldwide in the first trimester of pregnancy. We aimed to examine the diagnosis and management of tubal ectopic pregnancy in a large tertiary maternity hospital.

*Study Design:* This was a retrospective review of individuals treated for tubal ectopic pregnancy from 2017 to 2022. Records were identified from local databases. Anonymised data on risk-factors, symptoms and management was collected. Data were transcribed from electronic healthcare records and descriptive analyses performed.

*Results*: Of the 471 records identified; 20 were excluded as they were non-tubal ectopic pregnancies. Primary management employed was conservative (99/451, 22 %), medical (113/451, 25 %) and surgical (239/451, 53 %). Surgery was performed in 62.7 % (283/451) cases, including those who started in one treatment pathway but changed to surgical management. Most surgeries were performed in a co-located general hospital theatre (89.3 %), with 54.4 % undertaken out-of-hours. Laparoscopy was the commonest surgical approach (96.4 %) and salpingectomy the most prevalent procedure (99.3 %). Emergency surgical intervention, due to haemodynamic instability and/or suspected rupture, was required in 21.9% (62/283). Only 11.7% (33/283) of those managed surgically experienced adverse outcomes, with blood transfusion and high dependency unit admission the most common. A small proportion (10%) of individuals were provided with pregnancy loss information (including resources and support services available), highlighting the importance of recognising ectopic pregnancy as a pregnancy loss and not just a gynaecological emergency.

*Conclusion(s)::* In this large series, most tubal ectopic pregnancies had surgical laparoscopic management, but this was outside normal working hours and in a co-located general hospital. Management of tubal ectopic pregnancy was safe with minimal adverse outcomes.

# Introduction

The term 'normally sited pregnancy' refers to a pregnancy located within the uterine cavity while 'ectopic pregnancy' describes a pregnancy in an abnormal location. Ectopic pregnancies can be described as uterine or extra-uterine. Uterine ectopic pregnancies include scar, cervical and intramural pregnancies, while extra-uterine pregnancies include tubal, ovarian and abdominal pregnancies [1].

Ectopic pregnancy (EP)<sup>1</sup> is one of the most serious complications of early pregnancy [2]. It is associated with numerous adverse outcomes including, but not limited to, haemorrhage requiring blood transfusion, visceral injury at the time of surgery and maternal death [3]. EP remains

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<sup>&</sup>lt;sup>1</sup> EP: ectopic pregnancy.

the leading cause of death in the first trimester of pregnancy worldwide [4]. A recent publication in the United Kingdom (UK) demonstrated that delayed diagnosis of EP poses a significant risk to patients and may be fatal [5]. This publication noted that of the 12 maternal deaths in early pregnancy in the UK and Ireland from 2009 to 2014, nine were related to EP [5,6]. The rate of EP in Ireland in 2012 was 14.8 per 1,000 maternities [7], while the overall incidence of hospitalisations for EP from 2005 to 2016 was 15.1 per 1,000 deliveries [3]. This is in keeping with earlier work published in the UK (2013), which demonstrated an EP incidence of 11 to 20 per 1,000 live births [5].

Most ectopic pregnancies occur within the fallopian tube and can be further classified dependent on their location; ampullary (70 %), isthmic (12 %) or interstitial (2.4 %), [1,8,9]. Management of tubal ectopic pregnancy (TEP)<sup>2</sup> may be expectant, medical or surgical dependent on various clinical factors [2,7,10]. Expectant management is an option in haemodynamically stable individuals with small TEP and decreasing  $\beta$ -hCG with success rates in the region of 80 % provided that the initial  $\beta$ -hCG is < 1000 IU/L [7]. Medical management, with systemic administration of methotrexate, is an option in haemodynamically stable individuals with small TEP and  $\beta$ -hCG < 5000 IU/L [2,7]. Success rates for medical management have been reported as 79.3 % [11,12].

Surgical management is recommended in individuals with haemodynamic compromise,  $\beta$ -hCG > 5000 IU/L, TEP > 35 mm in size, or if fetal heart pulsation is present [7]. Laparoscopic approach is preferred however laparotomy may be unavoidable in emergent scenarios [7]. Complications may include visceral injury, vascular injury, haemorrhage or death [13,14]. This study aimed to identify and review the diagnosis and management of TEP in a single tertiary maternity unit in Ireland, examining and identifying possible adverse outcomes associated and areas for improvement.

# Methods

This was a retrospective review of electronic healthcare records of individuals treated for TEP in a large maternity unit. Eligible cases were identified using a local register of EP. The EP register was cross checked against the theatre logbook, the pharmacy methotrexate administration register as well as the gynaecology ward admission records to ensure a high degree of concordance and case ascertainment. All cases of TEP diagnosed at ultrasound and/or during surgery and treated in the unit between January 2017 and December 2022 were included. Exclusion criteria included non-tubal ectopic pregnancy or pregnancy of unknown location, and where records were incomplete. Cases diagnosed with TEP during May 2021 were excluded as data were incomplete due to a cyberattack that impacted electronic healthcare records [15]. Electronic healthcare records of eligible cases were reviewed and relevant anonymised clinical data on the diagnosis and management of the tubal ectopic pregnancy was extracted and transcribed to a password encrypted excel file for analysis. Clinical documentation including ultrasound reports, surgical records and medication administration history were all examined.

The maternity hospital in which this review was conducted is colocated with a general hospital with access to all emergency gynaecology theatre facilities located in the general hospital. The maternity hospital has an active pregnancy loss service comprising of consultant obstetrician-gynaecologists, non-consultant hospital doctors and bereavement and loss midwifery staff.

# Outcome measures

A data collection tool was developed, in MS Excel, to ensure standardisation of the data recorded. This tool was informed by national and international guidelines for management of tubal ectopic pregnancy [7,16] and the National Standards for Bereavement Care Following Pregnancy Loss and Perinatal Death and work of the National Care Experience Programme [17,18]. Data points for collection were agreed upon by the authors (DS, SL, KOD & DHR) and are fully outlined in Table 1. For the purpose of this study, elective surgical intervention referred to surgery performed at a time that was convenient for operators, while emergency surgical intervention refers to surgery performed due to clinical urgency.

# Statistical analyses

Descriptive analyses on the characteristics of individuals with TEP, the diagnosis and the care provided were performed in both Microsoft Excel and SPSS. Chi-square analyses was performed to compare timing (weekend and 8 h00-17 h00 or different schedule) of elective and emergency surgeries. Additionally, T-test allowed comparing the mean blood loss occurring in each type of surgery. Further analyses by management type (conservative, medical or surgical) was also completed.

# Ethical approval

Ethical approval was granted by Clinical Research Ethics Committee of the Cork Teaching Hospitals (CREC) (Ref.: ECM 4 (r) 20/06/2023).

# Table 1Data Points & Outcome Measures.

Patient Demographics	Age
	Parity
	Previous caesarean section
	Previous miscarriage
	Previous evacuation of retained products of
	conception
	Previous termination of pregnancy
Risk factors for ectopic	Risk factor(s) present
pregnancy	Assisted reproductive therapy
	Smoking status
	Previous ectopic pregnancy
	Intrauterine device in-situ
Diagnosis of ectopic	Referral source to the early pregnancy unit
pregnancy	Diagnosis of ectopic pregnancy on ultrasound when
	first suspected
	Symptoms at diagnosis
	Number of early pregnancy unit reviews prior to
	diagnosis
	Staff grade diagnosing ectopic pregnancy
	β-hCG at diagnosis
	Ultrasound findings at time of diagnosis
Management of ectopic	Most senior staff grade involved in decision making
pregnancy	regarding management
	Documented discussion of treatment options
	Documented written information provided to
	Individual
	Change to another management pathway
	If surgical management amployed
	I surgical management employed –
	Crade of staff performing surgery
	Concultant present at surgery
	Surgical approach
	Surgical approach
	Surgical procedure
Adverse Outcomes	Ped cell transfusion required
Adverse Outcomes	Massive obstetric baemorrhage
	Conversion to lanarotomy
	High dependency unit admission
	Intensive care unit admission
Follow-up of ectopic	Documented bereavement information provided
nregnancy	Documented discharge summary in electronic
pregnancy	healthcare record
	Relevant information (including diagnosis and
	management) within discharge summary
	Documented record of follow-up (virtual or face-to-
	face)

<sup>&</sup>lt;sup>2</sup> TEP: tubal ectopic pregnancy3 EPU: early pregnancy unit.

# Results

Of the 471 EP identified from hospital records (2017–2022) 20 were excluded as they were non-tubal, hence a total of 451 cases were included for final analysis.

#### **Demographics**

Demographics and risk factors for EP are shown in Table 2. Over half of individuals included in this review were multiparous (54.9 %) with over a third of these having had a prior caesarean section (35.8 %). Risk factors for EP were reported in 27.8 % (n = 126), however smoking status was found to be poorly documented so this may not be an accurate representation. Previous EP was the most prevalent risk factor (13.5 %) followed by assisted reproductive therapy (7.3 %). The most common source of referral to the Early Pregnancy Unit (EPU)<sup>3</sup> was the emergency department, comprising 55 % of all referrals.

# Diagnosis of ectopic pregnancy

Diagnosis of TEP was made on initial ultrasound in 72.1 % of cases (n = 264), with 27.3 % requiring more than one ultrasound evaluation prior to diagnosis (Table 3). Approximately one quarter of individuals were asymptomatic at the time of diagnosis (25.3 %), with abdominal/pelvic pain (32.4 %) and pain and bleeding (26.4 %) being the most common symptoms. Most individuals were seen in the emergency department prior to diagnosis (78.5 %), with 66.5 % having one emergency department visit and 12 % having 2 or more visits. Of those who attended the emergency department (n = 354), 58.2 % attended out of hours (1700 h-0800 h). The diagnosis of EP was predominantly made in the EPU (78.7 %) and by a midwife sonographer (84.7 %).

#### Table 2

Sociodemographic information of individuals with a diagnosis of tubal ectopic pregnancy in the maternity hospital (N = 451).

Sociodemographic characteristics	n (%)		
Age (years)	Range: 18–46 years Median: 34 years		
Parity			
Multiparous	254 (56.3 %)		
Previous Caesarean Section	93 (20.1 %)		
Previous Miscarriage	132 (29.5 %)		
Previous ERPC	16 (12.1 %)		
Previous TOP	15 (3.2 %)		
Risk factors present for ectopic pregnancy			
Assisted reproductive therapy	33 (7.3 %)		
Current smoker*			
Yes	14 (3.1 %)		
No	49 (10.9 %)		
Not documented	388 (86 %)		
Previous ectopic pregnancy	61 (13.5 %)		
Intrauterine device in-situ	18 (4 %)		
Referral source to Early Pregnancy Unit			
Emergency Department of Maternity Unit	248 (55 %)		
General Practitioner	113 (25.1 %)		
External ultrasound facility	16 (3.6 %)		
Other	10 (2.2 %)		
Self-referral	2 (0.4 %)		
Not referred <sup>**</sup>	62 (13.7 %)		

ERPC: evacuation of retained products of conception. TOP: termination of pregnancy.

 $^{\ast}$  Only n = 63, had smoking status documented, n = 388 (86 %) had no documented information on smoking status.

<sup>\*\*</sup> Those not referred to EPU were seen in the emergency department of the maternity hospital, fetal assessment unit (scanning department, generally for those greater than 12 weeks gestation) or patients requiring immediate surgical intervention

#### Table 3

Description of the diagnosis of tubal ectopic pregnancies (2017-2022).

	n (%)
Diagnosis of Ectopic Pregnancy on initial ultrasound	
Yes	327 (72.5 %)
No	122 (27.1)
No ultrasound performed*	2 (0.4 %)
Symptoms present at time of diagnosis of ectopic	
pregnancy	
Asymptomatic	114 (25.3 %)
Abdominal/pelvic pain	146 (32.4 %)
Vaginal bleeding	78 (17.3 %)
Pain and bleeding	111 (24.6 %)
Haemodynamic instability	2 (0.4 %)
Number of emergency department reviews prior to	
diagnosis of ectopic pregnancy	
0	97 (21.5 %)
1	300 (66.5 %)
$\geq 2$	54 (12 %)
Time of day of presentation if attended emergency	(N = 354)
department	
Weekday (08:00 to 17:00)	148 (41.8 %)
Weeknight (17:00 to 08:00)	110 (31.1 %)
Weekend day (08:00 to 17:00)	54 (15.3 %)
Weekend night (17:00 to 08:00)	42 (11.9 %)
Number of early pregnancy assessment unit reviews	
prior to diagnosis of tubal ectopic pregnancy	
0	75 (16.6 %)
1	250 (55.4 %)
>2	126 (27.9 %)
Gestational age at time of diagnosis of tubal ectopic	Range: 1 <sup>+4</sup> to 12 <sup>+3</sup>
pregnancy <sup>**</sup> (Weeks + days)	(weeks)
Duration (days) from first presentation/first review to	Range: 0 – 25 (days)
diagnosis of tubal ectopic pregnancy	Median: 2 (days)
Location of patient at time of diagnosis of tubal ectopic	
pregnancy	
Early pregnancy assessment unit	355 (78.7 %)
Emergency Department (Maternity Hospital)	47 (10.4 %)
Inpatient ward (Maternity Hospital)	5 (1.1 %)
Other	42 (9.8 %)
Staff grade diagnosing tubal ectopic pregnancy	
Midwife sonographer	382 (84.7 %)
Non-consultant hospital doctor (Obstetrics & Gynaecology)	48 (10.6 %)
Consultant (Obstetrics & Gynaecology)	20 (4.4 %)
Other	1 (0.2 %)
Time at diagnosis of tubal ectopic pregnancy	
Daytime working hours (08:00 to 17:00)	395 (87.6 %)

\* Clinically unstable patients requiring immediate surgical intervention

<sup>\*\*</sup> Gestation at diagnosis documented in n = 437 cases (97 %). Gestation based on last menstrual period (LMP) if documented, however if no LMP documented, gestational age derived from ultrasound findings.

# Ectopic pregnancy information

The median  $\beta$ -hCG at diagnosis of TEP was 1461 IU (range 1 – 192018 IU). An ultrasonographic description of the TEP at the time of diagnosis is shown in Table 4.

# Management of tubal ectopic pregnancy

Most individuals were in the EPU (40.4 %) or inpatient gynaecology ward (in the maternity hospital) (38.3 %) at the time of management decision. The mode of management was discussed with a Consultant Obstetrician/Gynaecologist in 87.2 % of cases. A documented discussion of management options with the individual was noted in 53.8 % cases, while documentation regarding the side effects of methotrexate was noted in 18.3 % and surgical risks in 26.2 %. The individual's preferred management option was documented in 26.0 % of cases. Primary management employed was conservative (21.6 %), medical (26.5 %) and surgical (51.9 %), with 68 individuals subsequently moving to a new management pathway (15.1 %).

<sup>&</sup>lt;sup>3</sup> EPU: early pregnancy unit.

#### Table 4

Ectopic Pregnancy Information.

β-hCG at diagnosis of ectopic pregnancy	$n = 444^{*}$
Range	1 – 192,018
	(IU)
Median	1484 (IU)
Ultrasonographic location of tubal ectopic pregnancy ectopic	
pregnancy (based on ultrasound report)	$n = 428^{**}$
Ampullary	410 (95.8 %)
Isthmus	3 (0.7 %)
Interstitial	15 (3.5 %)
Ultrasonographic description of the tubal ectopic pregnancy	$n = 420^{***}$
Inhomogenous mass	296 (70.5 %)
Bagel sign/empty gestational sac	23 (5.5 %)
Gestational sac with contents	101 (24.2 %)
Yolk sac present <sup>+</sup>	
	101 (100 %)
Fetal pole present <sup>+</sup>	73 (72.3 %)
Fetal heartbeat present <sup>+</sup>	47 (46.5 %)
Maximum dimensions of ectopic pregnancy	n = 399
Range	3 – 70 (mm)
Median	
	18 (mm)
Free fluid present on ultrasound at time of diagnosis	n = 448
	225 (50.2 %)

\* Documented hCG at time of diagnosis of ectopic pregnancy available for n = 444.

 $^{\ast\ast}$  Of all tubal ectopic pregnancies (n = 451), n = 428 have a documented location of the ectopic pregnancy with the tube.

\*\*\* Data available for n = 420.

 $^+$  Data available for n = 417.

Ectopic information based on primary management group (Conservative, Medical, Surgical)

Median  $\beta$ -hCG was 516 IU, 1085 IU and 3516.5 IU in the primary conservative, primary medical and primary surgical group respectively. Half (50.5 %) of the conservative management cases required further intervention and /or second line management (Table 5).

Among all included individuals, a very small proportion (8.2 %), received bereavement information or a leaflet with pregnancy loss information and supports. The majority of individuals (91.1 %) had a documented discharge summary in their medical record, with 62.1 % containing relevant information (including diagnosis and type of management), and 70.1 % having documented follow-up with a clinician (either face-to-face or virtually) (Table 6).

## Elective versus emergent surgical intervention

Overall surgical intervention was performed in 283 cases (62.7 %), with 78.1 % elective and 21.9 % emergent (Table 7). Most surgeries were performed in the co-located general hospital emergency theatre (89.3 %), with 54.4 % performed out of hours (1700–0800 h).

There was a statistically significant difference in the proportion of emergency surgeries carried out during the weekend (29 %) comparing to the proportion of elective surgeries (18 %;  $X^2$  (1, N = 284) = 4.332, p = 0.037). Similarly, the percentage of emergency surgeries performed out of hours (17 *h*00-08 *h*00; 79 %) was statistically significantly higher than the number elective surgeries (47 %; X2 (1, N = 284) = 4.332, p = 0.001). There was no statistically significant difference in the percentage of consultant presence at surgeries regardless of whether these were emergency or elective (p > 0.05).

Laparoscopy was the most common surgical approach (96.4 %), and salpingectomy the most common procedure (99.3 %). Only 10.2 % of those managed surgically experienced adverse outcomes, with blood transfusion and high dependency unit (HDU) admission the most prevalent. Of those managed by elective surgical intervention, 0.5 % (1/221) required HDU admission, compared to 9.7 % (6/62) in the emergency surgical intervention group. Of all individuals admitted to the HDU, 57.1 % (4/7) had surgical intervention performed out of hours. There was a statistically significant difference (t(56.6) = -7.37, p < 0.001) in

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#### Table 5

Details of management of Tubal Ectopic Pregnancy (n = 451).

	n (%)
Location of patient at time of decision of mode of	
management	
Early pregnancy assessment unit	174 (38.6 %)
Emergency department – Maternity Hospital	90 (20 %)
Inpatient ward – Maternity Hospital	181 (40.1 %)
Emergency department – Co-located General Hospital	4 (0.9 %)
General maternity ultrasound department	2 (0.4 %)
Most senior grade of staff involved in decision making on	
mode of management	
Senior house officer	2 (0.4 %)
Junior Registrar	4 (0.9 %)
Specialist Registrar	51 (11.3 %)
Consultant	394 (87.4 %)
Documented discussion of management options in chart	237 (52.5 %)
Documentation of impact of methotrexate choice recorded in charts	76 (16.9 %)
Documentation of risks of surgical procedure recorded in charts	109 (24.2 %)
Patient preferred management option documented in chart	114 (25.3 %)
Documented written information provided to patient	22 (4.9 %)
regarding management options for ectopic pregnancy	. ,
Primary management option employed	
Conservative	99 (22 %)
Medical	113 (25 %)
Surgical	239 (53 %)
Change to another management pathway required	68 (15.1 %)
Conservative to medical*	21 (21.2 %)
Conservative to elective surgical*	22 (22.2 %)
Conservative to emergent surgical*	6 (6.1 %)
Medical to elective surgical**	11 (9.7 %)
Medical to emergent surgical**	5 (4.4 %)
Surgical to medical***	3 (1.2 %)
Rh Negative	47 (10.4 %)

\* Percentage derived by comparing to number in primary conservative management group.

31 (100 %)

(days)

Range: 0 - 20

Median: 2 (days)

Anti-D immunoglobulin received if surgically managed

Length of inpatient stay at diagnosis

\*\* Percentage derived by comparing to number in primary medical management group.

\*\*\* Percentage derived by comparing to number in primary surgical management group.

<sup>+</sup> 31/31 surgically managed Rh negative individuals received anti-D immunoglobulin

the means of estimated blood-loss in emergency surgeries (M = 1027.0, SD = 767) compared to elective surgeries (M = 244.7, SD = 295). The small values in some of the cells for the remaining variables did not allow for further statistical analysis to be performed.

## Discussion

This retrospective review describes the diagnosis and management of TEP in a large tertiary referral maternity unit over a six-year period. The individuals in this review were often asymptomatic, required multiple reviews prior to diagnosis of TEP and rarely presented with haemody-namic instability. It is noted that a large proportion of surgical cases were performed out-of-hours by on-call staff. Overall, diagnosis and management of TEP was within national and international standards with low numbers of adverse maternal outcomes [7,16].

There was variation from international guidelines within the conservative and medically managed groups in this series. In the conservative management group, 21.2 % of cases had  $\beta$ -hCG at the time of diagnosis greater than recommended for conservative management (>1500 IU) [16]. Previous studies have reported reduced success and increased requirement for further management in the majority of TEP managed conservatively when initial  $\beta$ -hCG is > 3000 IU/L [19–21].

Three individuals in the medical management group had  $\beta$ -hCG

#### Table 6

Characteristics and details of care provided for ectopic pregnancies, according to primary management.

	Primary Conservative Management (N = 99)	Primary Medical Management (N = 113)	Primary Surgical Management (N = 239)
β-hCG at time of diagnosis of ectopic			
pregnancy			
Range	13 – 22,488 (IU)	27 – 18,469 (IU)	1 – 192,018 (IU) <sup>+</sup>
Median	516 (IU)	1085 (IU)	3516.5 (IU) <sup>+</sup>
Description of the			
ectopic pregnancy	97 (97 0 %)	09 (96 7 %)	111 (52 4 0/)*
Innomogenous mass	87 (87.9 %)	98 (80.7 %)	111 (53.4 %)*
gestational sac	5 (5.1 %)	5 (4.4 %)	13 (6.3 %)*
Gestational sac with	7 (7.1 %)	10 (8.8 %)	84 (40.4 %)*
contents			
Yolk sac present*	7 (7.1 %)	10 (8.8 %)	84 (41 %)
Fetal pole present*	3 (3.0 %)	4 (3.5 %)	66 (32.2 %)
Fetal heartbeat	2 (2.0 %)	2 (1.8 %)	43 (21 %)**
present*			
Maximum dimensions of	ectopic pregnancy		
Range	7 – 44 (mm)	3 – 41 (mm)	7 – 70 (mm)****
Median	16 (mm)	15 (mm)	20 (mm)***
Successful		13 (IIIII) 90 (70 0 0/)	20 (IIIII)
Successiui	50 (50.5 %)	89 (78.8 %)	230 (98.7 %)
management of ectopic pregnancy without need for further medical			
intervention			
Change to another	49 (49.5 %)	16 (14.2 %)	3 (1.3 %)
management			
Modical	21 (21 2 0/)	NI / A	2(1,2,0/)
Medical	21 (21.2 %)	N/A	3 (1.3 %)
Elective surgical	22 (22.2 %)	11 (9.7 %)	N/A
Emergency surgical	6 (6.1 %)	5 (4.4 %)	N/A
Repeat dose of		8 (7.1 %)	
methotrexate			
required			
Bereavement			
Information			
Deserves at a last	= ( = 1 ) )	0 (0 0 0/)	00 (10 1 0/)
bereavement information/leaflet	/ (/.1 %)	9 (8.0 %)	29 (12.1 %)
<b>Discharge summary</b> Documented discharge	80 (80.8 %)	103 (91.2 %)	228 (95.4 %)
summary in chart			
Correspondence sent to GP	80 (80.8 %)	101 (89.4 %)	226 (94.6 %)
Relevant information communicated to GP	54 (54.5 %)	71 (62.8 %)	155 (64.9 %)
Documented record of follow up	78 (78.8 %)	98 (86.7 %)	140 (58.6 %)
Seen in person in GOPD	12 (12.1 %)	8 (7.1 %)	106 (44 4 %)
Seen for virtual GOPD/	3(30%)	3 (2 7 %)	24 (10 %)
Phone follow up	3 (3.0 %)	3 (2.7 %)	24 (10 %)
Time from diagnosis of ectopic pregnancy to final discharge from service	n = 78	n = 81	n = 134
	Range: 4 – 153 (days) Median: 29	Range: 11 – 180 (days) Median: 31.5	Range: 3 – 236 (days) Median: 47
	(uays)	(days)	(days)

 $^+$  Data available for n = 232.

 $^{*}$  Data available for n = 208.

 $^{\ast\ast}$  Data available for n=205, more than one may be present.

\*\*\* Data available for n = 18.

# Table 7

Elective versus emergency surgical intervention.

	Elective Surgical Intervention	Emergency Surgical Intervention
	(78.1 %, N = 221)	(21.9 %, N = 62)
Location of surgery		
Cork University Hospital*	195 (88.2 %)	58 (93.5 %)
Cork University Maternity Hospital	26 (11.8 %)	4 (6.5 %)
Surgery performed over	40 (18.1 %)	19 (29 %)
weekend (Saturday/Sunday) <sup>a</sup>		
Time of Surgery <sup>a</sup>		
0800-1700	116 (52.5 %)	13 (21 %)
1700-0800	105 (47.5 %)	49 (79 %)
Primary surgical approach		
Laparotomy	4 (1.8 %)	6 (9.7 %)
Laparoscopy	217 (98.2 %)	56 (90.3 %)
Conversion to Laparotomy required	5 (2.3 %)	3 (5.4 %)
Pregnancy tissue sent to	217 (98.2 %)	61 (98.4 %)
histopathology for		
examination		
Grade of staff (obstetrics &		
gynaecology) performing		
surgery		
Senior House Officer	0 (0 %)	0 (0 %)
Junior Begistrar	0 (0 %)	0 (0 %)
Senior/Specialist Registrar	157 (71 %)	36 (58.1 %)
Consultant	64 (29 %)	26 (41.9 %)
Consultant present for surgery <sup>b</sup>	184 (83.3 %)	52 (83.9 %)
Primary Surgical Procedure	101 (0010 /0)	02 (0010 /0)
Salningectomy	219 (99 1 %)	61 (98.4 %)
Salpingostomy	2(09%)	1(16%)
Estimated blood loss	2 (0.9 /0)	1 (1.0 /0)
Bange	$0 - 1645(ml)^{**}$	$30 - 3400(ml)^{***}$
Median	100 (ml)	950 (ml)
Mean <sup>c</sup>	244 7 (ml)	1027.0 (ml)
Red Blood Cell transfusion	2(1%)	19 (30 6 %)
Required	2(1)0)	19 (00.0 %)
1 unit	0 (0 %)	5 (26 3 %)
2 units	1 (0 5 %)	9 (47 4 %)
>3 units	1 (0.5 %)	5 (26 3 %)
Intra-operative surgical	1(0.5%)	2 (3 2 %)
complications	1 (0.5 /0)	2 (3.2 /0)
Adverse Outcome		
Massive Obstetric Haemorrhage >	0 (0 %)	2 (3 2 %)
2.5L	- (0 /0)	_ (0.2 /0)
Sensis	0 (0 %)	0 (0 %)
HDU admission	1 (0 5 %)	6 (9.7 %)
ICU admission	0 (0 %)	0 (0 %)
Thromboembolic disease	0 (0 %)	0 (0 %)
in one of the cuscase	0 (0 /0)	0 (0 /0)

Note: Tubal Ectopic, n = 451; Primary Surgical Management, n = 239; Primary and Secondary Surgical Management, n = 283.

<sup>a</sup> Statistically significant difference (Chi-square test; p < 0.05);

<sup>b</sup> No statistically significant difference (p > 0.05);

 $^{\rm c}\,$  Statistically significance difference in the means (t-Test; p < 0.001).

\* Cork University Hospital: co-located general hospital with access to theatre facilities;

<sup>\*\*</sup> Data available for n = 159;

\*\*\* Data available for n = 54.

levels > 5000 IU/L and received methotrexate, contrary to current guidelines, as they were deemed poor surgical candidates [9,15]. Success of methotrexate for TEP correlates with  $\beta$ -hCG concentrations; upwards of 87 % when  $\beta$ -hCG levels are 500–999 IU/L and 82 % between 1000–1499 IU/L [22]. Considering the above, there is scope for improvement in both conservative and medical management care practices within the hospital. Education sessions on management of TEP and adherence to local policies and guidelines (based on both national and international literature) will help ensure optimal patient care [23,24].

Management of TEP in this study was not always discussed with consultants. A UK report demonstrated that patients in various

specialities, including obstetrics and gynaecology, have increased morbidity and mortality if there is a delay in involving consultants in their care or if they are treated in hospitals at weekends. The report concludes that consultant-delivered care has numerous benefits including rapid and appropriate decision making, benefits in the training of junior doctors and improved patient outcomes [25]. Staff dedicated to working in early pregnancy may reduce emergency surgical intervention for EP, reduce the number of laparotomies performed and increase the number of patients treated medically or conservatively [26]. Furthermore, senior clinicians experienced in early pregnancy may facilitate more doctors to be trained in laparoscopy (laparoscopic management of ectopic pregnancy), while other junior medical staff become trained in concepts of management of EP [26].

Similar to previous research in the UK [27], our findings show that surgical management was the most frequent mode of management for our TEP cohort. In our series, surgery was carried out by specialist registrars or consultants in all cases, regardless of whether the surgery was performed in an elective or emergent manner, as was the case in previous work published in the UK [28,29]. This points to a missed opportunity for training of more junior staff such as senior house officers and junior registrars. In cases where emergent surgical intervention was necessary it is understandable that the surgical intervention was performed by a senior clinician however, this accounts only for 21.9 % of cases. A Scottish study found that 47 % of consultants and 75 % of senior registrars reported competence in performing laparoscopic surgery for an EP unsupervised, while 29 % of consultants reported they did not have the skills to perform the surgery [30]. This highlights the need for training of junior levels of staff and strengthens the argument for a clinical lead in early pregnancy with the development of a dedicated EP team to provide this [26].

In our cohort most surgeries were performed in a co-located general hospital theatre (89.3 %), with over half of all surgeries (54.4 %) performed out-of-hours, regardless of whether it was elective or emergency surgical intervention. Additionally, the significantly higher number of emergency surgical intervention performed out of hours and over the weekend compared to elective surgical intervention was unsurprising. Those requiring surgical intervention often present with signs of TEP rupture and/or haemodynamic instability and frequently have some degree of haemoperitoneum at surgery, which contributes to the higher level of bloodloss reported in our findings Furthermore, emergency surgical intervention for TEP is often more complex than elective surgery due to the need for prompt surgical intervention and reduced visual field at the time of surgery due to haemorrhage.

Gaining access to the emergency general hospital theatre can be challenging, with limited availability these TEP surgeries must compete with other specialities for theatre time. A number of studies have demonstrated an increased mortality and morbidity associated with outof-hours or weekend surgical care [31,32]. A recent guideline published in Ireland has recommended that hospitals are responsible for designating appropriate surgical sites, deemed appropriate for the surgical intervention being performed [33]. As mentioned, this is not currently the practice in our unit where elective and emergency surgical intervention occurs in a co-located general hospital theatre. Potentially increased access to on-site services within our unit may reduce the number of surgeries performed out-of-hours and benefit patient care.

EP should be recognised and acknowledged as a pregnancy loss and the care provided should reflect that. From this series, it appears that only a small proportion of individuals were provided with pregnancy loss information during their interactions with staff. Previous research has demonstrated the psychological impact of EP [34,35]. A lack of bereavement care and follow-up after management of the EP was demonstrated in a previous Irish study, where detailed information regarding diagnosis and management also helped individuals' emotional recovery [35]. Offering relevant and appropriate information on pregnancy loss management and supports should be the very minimum expectation alongside high quality bereavement care for individuals with EP.

### Strengths and limitations

This large series of EP from a large tertiary- referral maternity hospital is one of few studies of this kind completed in the country.

The use of a local register (developed using ward, theatre and methotrexate registries) may pose a limitation for this series as there is potential for some cases of EP being missed. Cases managed conservatively/expectantly with a small adnexal mass and falling  $\beta$ -hCG are followed up with blood tests in the EPU and hence may not have been included in registers.

This review also relied on medical notes from electronic healthcare records. While these allow for more data availability, data collection can be hampered due to lack of recorded information. There is no standardised proforma for management of EP leading to varying amounts of data being entered into the healthcare record. This can be plainly seen in the lack of documentation regarding smoking status of individuals diagnosed with TEP.

#### Conclusion

This retrospective review examined the diagnosis and management of TEP in a large maternity unit in Ireland. Management of TEP in this series was safe with minimal adverse outcomes, despite not always adhering to current management guidelines (both national and international). Earlier diagnosis of TEP not only affords more management options but also allows for elective surgery rather than emergent. With updated guidelines for management of EP due for publication in Ireland, it is imperative these be implemented and adhered to in maternity units across the country. These guidelines should include standardised pathways for the diagnosis and management of TEP to ensure good quality patient care. Considering surgical management of TEP is common, all staff working within the maternity setting should be familiar with and trained in the provision of this. This review highlights the need to manage and support individuals with EP as a pregnancy loss, despite being a gynaecological emergency.

#### CRediT authorship contribution statement

**D. Synnott:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **S. Leitao:** Writing – review & editing, Supervision, Methodology, Conceptualization. **C. Everard:** Writing – review & editing, Data curation. **K.O.' Donoghue:** Writing – review & editing, Supervision. **D. Hayes-Ryan:** Writing – review & editing, Supervision, Methodology, Conceptualization.

# Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### References

- [1] Kirk E, Ankum P, Jakab A, Le Clef N, Ludwin A, Small R, et al. Terminology for describing normally sited and ectopic pregnancies on ultrasound: ESHRE recommendations for good practice. Hum Reprod Open 2020;4. https://doi.org/ 10.1093/hropen/hoaa055/6038915.
- [2] National Institute for Health and Care Excellence. Ectopic pregnancy and miscarriage: diagnosis and initial management. NICE Guideline, No 126. 2021; (November 24).
- [3] San Lazaro Campillo IS, Meaney S, O'Donoghue K, Corcoran P. Ectopic pregnancy hospitalisations: a national population-based study of rates, management and outcomes. Eur J Obstet Gynecol Reprod Biol 2018;231.
- [4] Autry AM. Medical treatment of ectopic pregnancy is there something new? Obstet Gynecol 2013;122.
- [5] Healthcare Safety Investigation Branch. Interim Bulletin: The diagnosis of ectopic pregnancy. 2018.

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- [6] Mother and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK. Saving Lives, Improving Mothers' Care. 2016.
- [7] Institute of Obstetricians and Gynaecologists. The Diagnosis and Management of Ectopic Pregnancy [Internet]. Royal College of Physicians of Ireland; 2014 [cited 2023 Sep 12]. Available from: https://rcpi-live-cdn.s3.amazonaws.com/wp-conte nt/uploads/2016/05/28.-Diagnosis-and-Management-of-Ectopic-Pregnancy.pdf.
- [8] Healthcare Safety Investigation Branch. The diagnosis of ectopic preganncy. 2020.
  [9] Bouyer J, Coste J, Fernandez H, Pouly JL, Job-Spira N. Sites of ectopic pregnancy: A 10 year population-based study of 1800 cases. Hum Reprod 2002;17(12).
- [10] Murray H, Baakdah H, Bardell T, Tulandi T. Diagnosis and treatment of ectopic pregnancy. CMAJ Canadian Medical Association Journal 2005;173.
- [11] Solangon SA, Van Wely M, Van Mello N, Mol BW, Ross JA, Jurkovic D. Methotrexate vs expectant management for treatment of tubal ectopic pregnancy: an individual participant data meta-analysis. Acta Obstet Gynecol Scand 2023;102.
- [12] Tulandi T. UpToDate. 2023 [cited 2023 Oct 11]. Ectopic pregnancy: Methotrexate therapy. Available from: https://www.uptodate. com/contents/ectopic-pregnancy-methotrexate-therapy?search=methotrexate% 20for%20ectopic%20pregnancy&source=search\_result&selectedTitle=1 ~150&usage type=default&display rank=1#H1531386832.
- [13] Mann WJ. UpToDate. 2023 [cited 2023 Oct 11]. Complications of gynecologic surgery. Available from: https://www.uptodate.com/contents/complications-o f-gynecologic-surgery?source=autocomplete&index=0~1&search=complication %20of%20gyn.
- [14] Pryor A, Mann WJ, Bates AT. UpToDate. 2023 [cited 2023 Oct 11]. Complications of laparoscopic surgery. Available from: https://www.uptodate.com/cont ents/complications-of-laparoscopic-surgery?search=ectopic%20pregnancy&topic Ref=3306&source=see\_link.
- [15] PricewaterhouseCoopers. Conti cyber attack on the HSE Independent Post Incident Review [Internet]. 2021 [cited 2024 Mar 6]. Available from: https://www .hse.ie/eng/services/publications/conti-cyber-attack-on-the-hse-full-report.pdf.
- [16] Elson CJ, Salim R, Potdar N, Chetty M, Ross JA, Kirk EJ. Diagnosis and management of ectopic pregnancy. BJOG 2016;123. https://doi.org/10.1111/ 1471-0528.14189.
- [17] Health Service Executive. National Standards for Bereavement Care Following Pregnancy Loss and Perinatal Death [Internet]. 2022 [cited 2023 Sep 12]. Available from: https://www.hse.ie/eng/about/who/acute-hospitals-divisio n/woman-infants/national-reports-on-womens-health/national-standards-for-bere avement-care-following-pregnancy-loss-and-perinatal-death.pdf.
- [18] National Maternity Bereavement Experience Survey. Early pregnancy loss: A scoping review of research in Ireland [Internet]. 2021 [cited 2023 Sep 12]. Available from: https://yourexperience.ie/wp-content/uploads/2021/10/Scoping-Review-of-Early-Pregnancy-Loss-in-Ireland\_12102021-1.pdf.
- [19] Takashima K, Yoshida H, Murase M, Sato A, Sakakibara H, Hirahara F, et al. Retrospective analysis of laparoscopic salpingostomy and conservative expectant management of tubal ectopic pregnancy. Reprod. Med Biol 2009;8(3).
   [20] Elson J, Tailor A, Banerjee S, Salim R, Hillaby K, Jurkovic D. Expectant
- [20] Elson J, Tallor A, Banerjee S, Salim R, Hillaby K, Jurkovic D. Expectant management of tubal ectopic pregnancy: prediction of successful outcome using decision tree analysis. Ultrasound Obstet Gynecol 2004;23(6).

- [21] Korhonen J, Stenman UH, Ylostalo P. Serum human chorionic gonadotropin dynamics during spontaneous resolution of ectopic pregnancy. Fertil Steril 1994;61 (4).
- [22] Lipscomb GH, McCord ML, Stovall TG, Huff G, Portera SG, Ling FW. Predictors of success of methotrexate treatment in women with tubal ectopic pregnancies. N Engl J Med 1999;341(26).
- [23] Lugtenberg M, Burgers JS, Westert GP. Effects of evidence-based clinical practice guidelines on quality of care: a systematic review. Qual Saf Health Care 2009;18 (5).
- [24] Institute of Obstetricians and Gynaecologists. National Women & Infants Health Programme. 2024 [cited 2024 Jun 4]. The Diagnosis and Management of Ectopic Pregnancy. Available from: https://www.rcpi.ie/Portals/0/Document%20Reposit ory/Institute%200%20Obstetricians%20and%20Gynaecologists/National% 20Clinical%20Guidelines/2024/Full%20Guidelines/National%20Clinical% 20Practice%20Guideline%20-%20The%20Diagnosis%20and%20Management% 200f%20Ectopic%20Pregnancy.pdf?ver=aQAObzuTTOkpmQqzpuqKcw%3d%3d.
- [25] Academy of Medical Royal Colleges. The Benefits of Consultant-Delivered Care [Internet]. Academy of Medical Royal Colleges. 2012 [cited 2023 Dec 17]. Available from: https://www.aomrc.org.uk/wp-content/uploads/2016/05/Benefits\_consultant\_delivered\_care\_1112.pdf.
- [26] Lavery S, El-Shawarby SA, Cloke B, Margara R, Trew G. A dedicated ectopic pregnancy team leads to an improvement in patients' management. Arch Gynecol Obstet 2007;275(6).
- [27] Taheri M, Bharathan R, Subramaniam A, Kelly T. A United Kingdom national survey of trends in ectopic pregnancy management. J Obstet Gynaecol 2014;34.
- [28] Azizia M, Phadnis S, Irvine LM. Surgical management of ectopic pregnancy in a district general hospital. J Obstet Gynaecol (Lahore) 2006;26(7).
- [29] Olagundoye V, Adeghe J, Guirguis M, Cox C, Murphy D. Laparoscopic surgical management of ectopic pregnancy: a district general hospital experience. J Obstet Gynaecol (Lahore) 2000;20(6).
- [30] Davidson EJ, Nicholson SC. Management of ectopic pregnancy in a Scottish teaching hospital: Implications for training. J Obstet Gynaecol (Lahore) 2002;22 (2).
- [31] Yang N, Elmatite WM, Elgallad A, Gajdos C, Pourafkari L, Nader ND. Patient outcomes related to the daytime versus after-hours surgery: a meta-analysis. J Clin Anesth 2019;54.
- [32] Cortegiani A, Ippolito M, Misseri G, Helviz Y, Ingoglia G, Bonanno G, et al. Association between night/after-hours surgery and mortality: a systematic review and meta-analysis. Br J Anaesth 2020;124.
- [33] Committee NCE. Unexpected Intraoperative Life Threatening Haemorrhage National Clinical Guideline. HIQA Guidelines. 2022.
- [34] Lasker JN, Toedter LJ. The impact of ectopic pregnancy: A 16-year follow-up study. Health Care Women Int 2003;24(3).
- [35] Spillane N, Meaney S, O' Donoghue K. Irish women's experience of Ectopic pregnancy. Sex Reprod Healthc 2018;16.