REVIEW ARTICLE

Review article: The use of pelvic examination within the emergency department in the assessment of early pregnancy bleeding

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Abstract

Early pregnancy bleeding is a common presentation in the emergency setting. Traditionally, its assessment relied on clinical findings, including pelvic examination. However in recent years, ultrasonography and quantitative beta human chorionic gonadotropin assays have gained prominence and are now first-line in diagnosing early pregnancy bleeding. Accordingly, the role of pelvic examination in the acute setting has been increasingly questioned. This article reviews the evidence for the role of pelvic examination in the assessment of early pregnancy bleeding in the ED. A Medline search was conducted and 43 articles were included in this review. Applicable research is largely observational and of a low level of evidence. However, available data indicate that the role of pelvic examination in the assessment of early pregnancy bleeding is limited, providing that there is prompt access to transvaginal ultrasound examination. Pelvic examination does not provide further diagnostic information over ultrasonography used in conjunction with beta human chorionic gonadotropin assays. The routine use of pelvic examination is not supported by the literature. However, when ultrasonography and beta human chorionic gonadotropin testing are unavailable or the results inconclusive, pelvic examination should be considered. Assessment in these instances must focus on identifying possible life-threatening conditions, such as ectopic pregnancy, as well as determining the safety of discharge pending definitive assessment. Speculum examination is indicated in those presenting with severe bleeding or hypotension as removal of obstructing endocervical products can be a crucial resuscitative measure.

Key words: *ectopic pregnancy, emergency department, physical examination, spontaneous abortion.*

Introduction

Early pregnancy bleeding (EPB) is defined as bleeding within the first 20 weeks of gestation. It complicates approximately 20% of pregnancies, with half of these resulting in miscarriage.[1,2] Recent US statistics report that it accounts for 1.6% of all ED visits.[3] The most frequent causes of EPB are listed in Box 1.[4,5]

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Box 1. Aetiology of early pregnancy bleeding

Causes of early pregnancy bleeding
  Bleeding in a viable pregnancy[6,7] (~50%)
  Miscarriage (non-viable pregnancy)[2,8] (30–50%)
  Ectopic pregnancy[9] (~7%)
  Other:[10] (<1%)
    Trophoblastic disease
    Lesions of cervix/vagina

Pelvic examination, defined as bimanual palpation and speculum examination, is historically an expected component of the initial assessment of all women with EPB.[5,11,12] It is an invasive procedure and in the ED setting performed at a time when a woman is likely to be suffering significant psychological distress.[13]

Traditional teaching states that pelvic examination has the following roles in the diagnosis and management of EPB. Bimanual palpation allows differentiation between a threatened and inevitable miscarriage through determining the state of the cervical os.[11] With respect to ectopic gestations, cervical motion tenderness (CMT) and adnexal tenderness or masses can be appreciated.[14] A speculum examination with visualization of the cervix allows for an estimation of bleeding severity and permits the removal of any endocervical products of conception. Rarely, culprit cervical lesions might be identified.

In recent years studies have brought into question the sensitivity and reliability of pelvic examination within the evaluation of EPB.[14–17] Over the same time, ultrasound technology and its accessibility have improved and its role within the assessment of EPB has gained prominence.[8] Obstetric sonography subspecialization within the disciplines of Radiology and Obstetrics and Gynaecology reflects this. Transvaginal ultrasonography (TVUS), used in conjunction with sensitive β subunit human chorionic gonadotropin (βhCG) assays, is considered the investigation of choice in the initial assessment of EPB.[6,15,18–24] Timely ultrasound allows early differentiation of the aetiology of EPB and its subsequent management. It has also become an expectation among women presenting with complications in early pregnancy.[25] The availability of TVUS among Australian ED has not been previously reported. In the general practice setting it appears to be widely available, with 66–84% of women presenting to their GP being referred for an ultrasound scan.[26]

In light of the improved availability and sophistication of ultrasound, the use of performing pelvic examination in women presenting with EPB in the emergency setting is the subject of this review article.

Objectives

This review aims to clarify the role, within the ED, of pelvic examination in the assessment of EPB. Specifically, the reliability and sensitivity of pelvic examination in diagnosing the causes of EPB will be considered.

Methods

A literature search was conducted through Medline (1950 to March 2009) using the following terms; {speculum OR bimanual OR pelvic exam$ OR physical exam$ OR assess$} AND {bleed$ OR antepartum haemorrhage OR threatened miscarriage OR threatened abortion} AND {early pregnancy OR first trimester OR ectopic}. Limitations of English language and human studies were applied.

From this search result, all abstracts were screened. Full texts were obtained when the abstract revealed potential information on clinical examination or diagnosis in EPB. Case reports were excluded from analysis. Further potentially relevant papers were identified via searching through the references of pertinent articles. Studies identified by the search strategy were classified according to the National Health and Medical Research Council's levels of evidence hierarchy as described in Box 2.

Box 2. National Health and Medical Research Council levels of evidence hierarchy[27]

Level I: Evidence from a systematic review of all randomized controlled trial (RCT)
Level II: Evidence from at least one well-designed RCT
Level III-1: Evidence from a pseudo RCT
Level III-2: Evidence from a comparative study with concurrent controls; cohort study, case–control study, interrupted time series with a control group
Level III-3: Evidence from a comparative studies with historical controls
Level IV: Evidence from case series

The articles were reviewed to identify the role of pelvic examination in assessing each of the causes of EPB, including ectopic pregnancy (EP), miscarriage, physiological bleeding, as well as other infrequent causes, such as trophoblastic disease and cervical/vaginal lesions.

Results

The described search yielded 300 articles. Following an abstract screen, 62 full-text articles were sought. A manual search of article references revealed a further nine potentially relevant papers. Of these 71 full-text articles, 28 articles were excluded on the basis of not matching the review objectives and 43 were chosen for detailed appraisal.

There were 20 prospective observational studies, 7 retrospective chart reviews, 13 review articles, 2 surveys and 1 descriptive study. These translate to National Health and Medical Research Council's level of evidence categories of III-2 to IV.

Discussion

Diagnosing EP

Ectopic pregnancy is a significant disease in the child-bearing population and can lead to pain, infertility, haemorrhage and death.[7] Early detection potentially permits a more conservative management approach allowing tubal conservation.[28,29] However, EP is frequently misdiagnosed, with 12% being missed on first presentation in one Australian series, which resulted in delayed diagnosis and an increased rate of salpingectomy.[30]

Pelvic examination findings

Features on bimanual examination that are suspicious for EP are the presence of CMT, adnexal tenderness or adnexal masses. Speculum examination should reveal a closed cervical os with no visible endocervical products of conception. Of note, the clinical triad of pain, vaginal bleeding and adnexal mass is non-specific and is actually encountered more commonly in miscarriage.[19,31]

The contribution of clinical examination in the investigation and diagnosis of EP has been reported in six studies, which are listed in Table 1. These studies highlight the difficulty in clinical diagnosis given the frequency of positive pelvic examination findings in patients with EP. CMT, adnexal tenderness and an adnexal mass were detected in 45%, 61% and 14%, respectively, of women presenting with EP. This might in part reflect the poor sensitivity of bimanual examination in detecting the presence of certain positive findings. Padilla *et al.* reported a sensitivity range of 21–36% in detecting an adnexal mass larger than 5 cm in 140 anaesthetized women undergoing laparoscopy or laparotomy.[34] Overall, these tabulated studies do not support reliance on clinical examination alone in the diagnosis of EP.

Ancillary investigations

In modern practice ancillary investigations have gained prominence in the diagnosis of EP. Using TVUS in conjunction with βhCG levels has proven to be highly sensitive in the detection of EP,[29,33,35–38] such that it is recognized as first-line in EP assessment.[15] Articles published by Durham *et al.* and Sadek *et al.* report the sensitivity of TVUS in detecting EP as 90% and 96.2%, respectively.[22,35] However, TVUS has its limitations. An indeterminate scan is found in about 15% of women with EPB at initial presentation.[22,39] An EP is eventually diagnosed, via serial βhCG and TVUS,[22] in 14% of these women with initial indeterminate scans.[39]

Role of pelvic examination

There are a number of studies that have sought to clarify a role for pelvic examination in the diagnosis of EP. Buckley and colleagues hypothesized that there was a role for clinical examination in the diagnosis of EP in estimating pretest (laboratory investigation/ultrasound) probability or for when these tests are non-diagnostic.[20] This prospective observational study, through recursive partitioning, stratified women into high-, intermediate- and low-risk groups with rates of EP of 27.3%, 7.4% and 1.1%, respectively. Inclusion into the high-risk group required evidence of peritonism or definite CMT. Low-risk criteria were defined by the detection of foetal heart sounds, the presence of products of conception or if pain was midline and consistent with menstrual cramping. If none of these features were present, the woman was considered to be of an intermediate risk. The intermediate group had a prevalence of EP approaching that of the total population of women presenting with symptomatic pregnancies. The clinical relevance of the paper is questionable with over 70% of the population of interest falling into this intermediate stratum, where there is no change in pretest probability.[37] Buckley's team went on to attempt to validate this

Table 1. Pelvic examination in ectopic pregnancy

Author	Year	Study design	Total with ectopic	Total studied	Pelvic examination				
					Cervical motion tenderness present	Adnexal tenderness	Adnexal mass	Open os	Passage of tissue
Abbott et al.[32]	1990	Retrospective	65	65		58	10		
Stovall et al.[9]	1990	Prospective	161	2157	86	89	34		
Kaplan et al.[7]	1996	Prospective	56	439	24	36			
Buckley et al.[20]	1998	Prospective	39	486	13	27	2	1	0
Dart[33]	1999	Prospective	57	438	18	29	5	4	
Mol et al.[15]	1999	Prospective	116	382		62	12		2
				Totals	141/313	301/494	63/438		
				%	45	61	14		

clinical prediction model, but concluded that the clinical findings that predicted the presence or absence of EP were found too infrequently to affect medical decision-making substantially.[40]

Similarly, Mol et al.'s study examined the extent to which physical examination, abdominal examination and pelvic examination contributed to the diagnosis of EP, in isolation and in conjunction with TVUS and βhCG measurement.[15] They created separate logistic models in the diagnosis of EP using the c index, equivalent to area under the receiver operating curve as a marker of diagnostic performance. Physical examination alone had a c index of 0.76, while transvaginal sonography and βhCG measurements had a c index of 0.90 ($P < 0.001$). The combination of the TVUS, βhCG and physical examination had a c index of 0.92 ($P = 0.07$), which was a modest but statistically non-significant improvement over TVUS and βhCG alone.

Of note, these models rely on the accurate determination of abnormal bimanual examination findings to identify those at high risk of EP. The inter-examiner reliability of bimanual pelvic examinations within the ED was demonstrated to be poor by Close and colleagues.[41] One hundred and eighty-six women underwent sequential bimanual examination by an emergency resident and by an emergency physician. Although the overall agreement with examination findings was acceptable, with ranges of 71–84% found, there was poor agreement in every category in relation to abnormal findings. In the positive pelvic examination, agreement was only 17% for CMT, 33% for uterine tenderness, 32% for adnexal tenderness and 23% for an adnexal mass.

Experience bias might account for this poor agreement, as over half of the examinations were performed by an emergency resident, with relatively limited experience in gynaecological assessment. However in practice, junior staff perform the majority of pelvic examinations in the ED. Buckley et al. reported figures of 88%[40] and Chilaka et al. 94%,[42] as proportions of gynaecological examinations performed by staff of a resident level and below.

Summary

A specific role for pelvic examination in the diagnosis of EP is not supported in the literature. Predictive clinical features are unreliably expressed in EP and the sensitivity of pelvic examination in detecting these is low. Pelvic examination findings cannot be relied on in isolation to diagnose EP. TVUS in conjunction with βhCG

levels has a high sensitivity for detecting EP and should be considered first-line in its assessment. Importantly, diagnostic accuracy is not significantly improved with the addition of pelvic examination.

Diagnosing miscarriage

Miscarriage is defined as a pregnancy spontaneously terminating before completion of the 20th week of gestation.[24] The majority of these are due to genetic abnormalities, particularly trisomy mutations. The remainder can be attributed to environmental causes.[23] Clinically, miscarriage is further differentiated as threatened, incomplete or complete.

Pelvic examination findings

A threatened miscarriage describes the circumstance where a patient presents in early pregnancy with vaginal bleeding but no history of passing tissue and no evidence of cervical dilatation. There is a 30–50% probability of eventual abortion in this group.[8] An open cervical os or the presence of products of conception confirms an inevitable miscarriage, which is further classified as incomplete or complete depending on the degree of uterine evacuation. A missed miscarriage, or blighted ovum, refers to foetal demise before the 20th week of gestation, with an ultrasound scan demonstrating a non-viable pregnancy.

Studies that reported the results of pelvic examination findings in women presenting to emergency with EPB and subsequently are found to have had a miscarriage are shown in Table 2.

Pelvic examination findings conclusive for miscarriage are not present in the majority of women who have a non-viable pregnancy. An open os is only found in 24%[6,43] of women who subsequently miscarry, and the presence of products of conception on speculum examination is an even more uncommon finding, present in 13%.[43] However, differentiating the state of the cervical os at times is not straightforward.[8] An open os was reported in 12 out of 214 cases of normal intrauterine pregnancies in one series.[6] Although this can be put down to inexperience of the examiner, mistaking an open external os for an open internal os,[6] it does highlight the potentially subjective nature of the examination.

Ancillary investigation

Most women who present with miscarriage do not have conclusive examination findings.[6,15,43] Historically

these women would have been treated expectantly.[8] The development of ultrasound, particularly TVUS in the late 1980s,[44] has made for accurate diagnosis of pregnancy status[21] and better differentiation between viable and non-viable pregnancies.[24] Ultrasonographic features of miscarriage depend on the developmental state of the pregnancy on presentation.[24] Once βhCG levels are over 1000–2000 mIU/mL for TVUS and 2400–3600 mIU/mL for transabdominal ultrasound, depending on the quality of the machine and experience of the ultrasonographer, the intrauterine gestational sac should be reliably visualized and pregnancy viability can be assessed.[24] Approximately 85% of symptomatic women have βhCG values over 1000 mIU/mL.[45] Of those women with βhCG levels on presentation less than 1000 mIU/mL, sensitivity of diagnosing a miscarriage is low at 13%.[45] Serial βhCG testing and repeat TVUS eventually confirm viability or non-viability in this population. Furthermore, in experienced hands, TVUS can detect products of conception within the cervix that should prompt removal on speculum examination.

Role of pelvic examination

Pelvic examination can provide diagnostic information in the case of miscarriage. However, although cervical dilatation or the presence of products of conception confirm miscarriage, these findings occur infrequently and when they are present, they can be difficult to interpret. The use of speculum examination was examined by Hoey and colleagues in a cohort of 236 women presenting with EPB.[14] In that series, speculum examination affected a minority of decision-making, changing management in 1.3% of cases and diagnosis in 4.2% of cases. This coincided with cases in which the clinician was unable to evaluate the state of the cervix by bimanual palpation. With respect to performing a speculum examination to estimate blood loss in miscarriage, good correlation between the amount of bleeding stated by women and speculum findings were found in a separate prospective observational study of women presenting with EPB.[16] Haemodynamically unstable patients were typically excluded from analyses. Heavy vaginal bleeding, vagal bradycardia due to obstructing products in the cervix and haemorrhagic shock are all indications for speculum examination, as removal of obstructing products of conception can be a key resuscitative measure in this population.

Table 2. Pelvic examination in miscarriage

Author	Year	Study design	Total with miscarriage	Total studied	Pelvic examination				
					Cervical motion tenderness present	Adnexal tenderness	Adnexal mass	Open os	Passage of tissue
Kaplan et al.[7]	1996	Prospective	153	439	28	69			
Chung et al.[43]	1999	Prospective	369	739				87	32
Dart et al.[6]	1999	Prospective	167	438	15	40	5	41	32
Mol et al.[15]	1999	Prospective	43	382		6	4		9
				Totals				128/536	73/579
				%				24	13

Summary
The diagnostic information required to manage a patient with a miscarriage is acquired through ultrasonography and βhCG levels. Pelvic examination should be considered in the setting where ultrasound is not available in the acute episode as it can provide diagnostic information in a minority of women presenting with potential miscarriage.

Diagnosing bleeding in a viable pregnancy

Potential mechanisms for bleeding in a viable pregnancy include physiological bleeding on implantation[5] as well as pathological causes, such as spontaneous subchorionic haemorrhage.[24]

Pelvic examination findings
Diagnosis of a normal pregnancy hinges on confirming viability, and excluding causes of non-viability. Pelvic examination features that are suggestive of a viable pregnancy include minimal tenderness, benign adnexae, a closed cervical os and the absence of products of conception. However, these findings are all non-specific, and are commonly found in non-viable pregnancies.[6,18,43]

Table 3 lists studies that have documented the pelvic examination findings in viable pregnancies complicated by EPB. This demonstrates the overlap in examination findings among different causes of EPB, making differentiation between a viable and non-viable pregnancy on clinical grounds alone difficult.[7,9,33]

Ancillary testing
Transvaginal ultrasonography allows more precise pregnancy prognosis.[8] TVUS can detect a viable pregnancy as early as 6 weeks of gestation where the detection of embryonic cardiac activity is possible.[24] Detection of a viable intrauterine pregnancy confers a 70–90% probability of full-term viability.[8] The diagnostic value of ultrasound is limited in women with symptomatic pregnancies that have βhCG values below 1000 mIU/mL.[45] Typically, this population is treated conservatively, with serial βhCG monitoring until the discriminatory level is reached, or the values taper away.

Role of pelvic examination
Pelvic examination findings do not contribute towards diagnosing a normal pregnancy in women presenting with EPB.

Table 3. Pelvic examination in normal intrauterine pregnancy

Author	Year	Study design	Total with normal pregnancy	Total studied	Pelvic examination				
					Cervical motion tenderness present	Adnexal tenderness	Adnexal mass	Open os	Passage of tissue
Kaplan et al.[7]	1996	Prospective	230	439	46	120			
Stovall et al.[9]	1990	Prospective	349	2157	13	50	26		
Chung et al.[43]	1999	Prospective	370	739				0	0
Dart et al.[6]	1999	Prospective	214	438	36	81	13		
Mol et al.[15]	1999	Prospective	157	382		21	7	12	2

Summary

Findings on pelvic examination typical of physiological bleeding in a viable pregnancy are non-specific and can be encountered in non-viable gestations. In the normal intrauterine pregnancy, viability is best confirmed by ultrasonography.

Diagnosing other causes of EPB

Diagnosing lesions of the cervix/vagina

Lesions of the cervix and vagina can be visualized on speculum examination. Typically these lesions are benign and include cervical ectopy, polyps and minor trauma. Cervical malignancy, however, is an important finding and would require significant intervention during the pregnancy.[42] The incidence of cervical cancer in pregnancy is rare, and has been documented as 7.5 cases per 100 000, half of which had an abnormal smear preceding.[46] Thirty to forty-six per cent of these patients are entirely asymptomatic.[46]

Many difficulties arise in the emergency setting in making this rare diagnosis. Concurrent bleeding, a junior examiner and the inherent difficulty in visualizing the cervix in pregnancy[42] make interpretation of a speculum examination difficult.

Benign cervical ectopy has previously been described in 37% women, with higher rates in pregnancy.[42] The reporting of cervical ectopy on speculum examination in only 11.7%[16] and 21.5%[42] of women with antepartum haemorrhage in separate UK series is concerning for the under-recognition of any cervical pathology in the acute setting. It has been suggested that if speculum examination is being performed to exclude cervical malignancy, it should be performed by at least a specialist registrar who can recognize abnormal pathology requiring early intervention.[42] Certainly the rationale for performing a routine speculum examination in all patients presenting with EPB to exclude cervical lesions appears questionable. It would seem appropriate if this was reserved for women with previously abnormal smears or if significant trauma was suspected.

Trophoblastic disease

Gestational trophoblastic disease is a spectrum of pregnancy-related proliferation and oedema of villous stroma, with rates ranging from 0.1% to 0.5% of pregnancies.[23] Although clinical features of hyperemesis and uterine enlargement out of proportion of dates[10] might be suggestive of a molar pregnancy, the clinical presentation is typically indistinguishable from a

normal pregnancy.[23] Rarely, the passage of vesicles through the vagina is diagnostic.[10] Typically, the diagnosis is suggested by excessively high βhCG levels and confirmed through visualization of a molar pregnancy on ultrasonography.[10,23]

Limitations

The main limitation of this review is the paucity of higher levels of evidence in this area of research. Applicable studies have been largely observational and none has been controlled. Avenues of further research should centre on methodology that is more scientifically robust. More specifically, in ED where timely ultrasonography is unavailable, the use of pelvic examination in the evaluation of EPB could be better assessed given that this is most likely where the role for pelvic examination in the diagnosis of EPB lies.

Conclusion

In the emergency setting, timely access to TVUS and βhCG measurement is paramount in the assessment of EPB and has a high diagnostic accuracy for all major causes of EPB. In the circumstance when ancillary testing is unavailable or non-diagnostic, pelvic examination should be considered. However, in the clinical setting where both of these investigations are readily available, pelvic examination provides little further diagnostic information and as such its routine use is unnecessary.

Speculum examination should be performed as part of the resuscitative management of women presenting with EPB who have severe bleeding, vagal bradycardia or associated haemorrhagic shock. It should also be performed when there is a history of recent abnormal smears.

Acknowledgements

Author contributions

Competing interests

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