**Under-classified obstetric anal sphincter injuries**

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**Abstract**

**Introduction**

Obstetric anal sphincter injuries (OASIs) that are missed at delivery can have long term consequences. OASIs that are under-classified at delivery are likely to be inadequately repaired, resulting in a persistent anal sphincter defect.

We aimed to identify women who have persistent defects on endoanal ultrasound, inconsistent with the original diagnosis and compare the effect on St Mark’s Incontinence Scores (SMIS). We also aimed to look for changes in numbers of under-classification over time.

**Methods**

Records of women attending a perineal clinic who had endoanal ultrasound from 2012 to 2020 were reviewed. Women who had a modified Starck score implying a defect greater than the classification (indicated by the depth of external anal sphincter or internal anal sphincter (IAS) defect) at delivery were identified.

**Results**

A total of 1056 women with a diagnosis of 3a or 3b tears were included. Of these, 120 (11.36%) were found to have a defect greater than the original diagnosis; therefore, incorrectly classified at delivery.

Women who had a 3b tear diagnosed at delivery, but had an IAS defect, had a significantly higher SMIS (p < 0.01). When comparing two four-year periods there was a significant improvement in the diagnosis of IAS tears.

**Conclusion**

Some women with OASIs that have under-classified OASIs are associated with worse anorectal symptoms. This is likely because of an incomplete repair. Some improvement in diagnosis of IAS tears has been noted. We propose improved training in OASIs can help reduce the number of incorrectly classified tears and improve repair.

**Key words (6 allowed)**

Obstetric anal sphincter injuries

Diagnosis of third degree tears

St Mark’s Incontinence Score

Starck Score

Endoanal Ultrasound

**Brief Summary**

Under-classified obstetric anal sphincter injuries can result in inadequate repair resulting in a persistent defect detected on endoanal ultrasound.

**Introduction**

Obstetric anal sphincter injuries (OASIs) affect 2.9% of deliveries in the United Kingdom [1]. The Sultan classification for perineal tears, which includes OASIs, is universally accepted [2]. Best practice dictates that diagnosis and classification of OASIs should take place immediately after delivery, by performing a systematic combined digital rectal and vaginal examination [3]. It is important for healthcare professionals involved in delivery and diagnosis of perineal trauma to be aware of the anatomy of the perineum, as this knowledge is required to correctly classify and repair the tear. Older studies comparing endoanal ultrasound (EAUS) findings to clinical findings have shown evidence of incorrect classification of perineal tears [4,5].

EAUS is the gold standard investigation for imaging and assessing pathology of the anal sphincter [6]. OASIs that were not diagnosed clinically at delivery, but identified on ultrasound weeks after delivery, during the post-natal period, were originally believed to be ‘occult’ injuries [7]. However, a subsequent study where women were re-examined after delivery by an experienced research fellow with EAUS performed immediately, and six weeks after delivery, revealed that the previously believed “occult” injuries were in fact missed tears in nearly all cases [4].

OASIs that are missed, or not repaired at the time of delivery, can cause long term consequences, such as anal incontinence [5,8–10]. If a tear is under-classified, for example, a 3c tear (complete external anal sphincter (EAS) and internal anal sphincter (IAS) tear) is diagnosed as a 3b tear (IAS intact) this would result in an inadequate repair, as the torn IAS would not be identified or repaired. This will lead to a persistent defect in the IAS, which can be seen on endoanal ultrasound. Sphincter defects on EAUS can be objectively quantified using the Starck score (Table 1) [11]. The validated St Mark’s Incontinence Score (SMIS) can be used to subjectively assess anal incontinence [12]. Previous studies comparing SMIS to defects detected on EAUS have shown a positive correlation [13], suggesting that poorly repaired OASIs can lead to worse anal incontinence symptoms.

The primary aim of this study is to identify women who have defects on EAUS which are not in keeping with the original classification made at delivery and to compare the effect on the SMIS with those that have been correctly classified at delivery. During the last twenty years awareness and education of OASIs has changed, largely due to the availability of training courses [14,15]. Hence, we also aimed to assess any improvement in diagnosis by comparing rates of missed tears over an eight-year period.

**Methods**

A prospectively collected dataset of women attending a perineal clinic at Croydon University Hospital, a tertiary referral unit, between January 2012 to July 2020 was reviewed. As this is part of normal practice for this clinic, institutional board and research ethics committee approval was not deemed necessary. Only women who had delivered at our unit or had been referred from tertiary centres which had clearly documented the grade of tear at delivery were included. This was to ensure the classification of tear was accurate, therefore avoiding reliance on the patient remembering the classification herself. Women attending the perineal clinic are seen approximately three months after an OASIs or antenatally during a subsequent pregnancy between 28- and 34-weeks gestation. Women who were seen both postnatally and antenatally were only included once in the analysis, using the most recent appointment. It has previously been shown that there were minimal discrepancies identified in the subsequent antenatal EAUS when compared to the post-natal scan [16].

Women attending the clinic underwent a thorough evaluation including assessment of anorectal symptoms and EAUS. Anal incontinence symptoms were recorded using the validated SMIS which gives a score between 0 and 24, with 24 being most severe [12]. EAUS was performed with either Pro-focus 2202 or Flex-focus 500 ultrasound system (BK Medical, Herlev, Denmark). Images were obtained at four levels (puborectalis, deep, superficial and subcutaneous levels). A three-dimensional image was also obtained. Images were reviewed by experts, trained in EAUS, and persistent anal sphincter defects were quantified (a defect is only reported when a gap of more than 30o is seen on EAUS), based on the depth of tear seen on EAUS, and recorded using the Starck score [11]. See Table 2 for a description of tears graded using the Sultan clinical classification and associated sonographic scoring on the Stark Score. Only women who had a diagnosis at delivery of 3a or 3b tear were included. Women with an original diagnosis of 3c or 4th degree tears were excluded because they are unlikely to be under-classified. In addition, under-classification of these 3c or 4th degree tears cannot be confirmed on EAUS because tears in the rectal mucosa cannot be identified on ultrasound. Women who had a modified Starck score (Table 1) implying a defect greater than the classification of OASIs given at delivery were identified, i.e. if there was a defect equivalent to a 3c tear and the woman was diagnosed as a 3b or 3a tear at delivery. The SMIS for women with under-classified OASIs was compared to those who had EAUS findings consistent with the diagnosis given at delivery, i.e. no defect or a defect equivalent to the OASIs diagnosis given at delivery.

Statistical tests were performed using SPSS V26. The Mann Whitney U test and the Kruskal Wallis tests were used to compare the SMIS for the different groups.

The diagnosis at delivery was split into two four-year periods (2012-2015 and 2016-2019) based on date of delivery, and the Chi squared test was used to compare under-classified tears during those periods. A corresponding p value of < 0.05 was considered statistically significant.

**Results**

A total of 1271 patients sustained OASIs; 496 women with a 3a tear, 560 women with a 3b tear, 147 women with a 3c tear and 68 women with a 4th degree tear diagnosed at delivery (Table 3). 1056 (83.1%) of these women were classified as 3a or 3b tears. When reviewed in the perineal clinic 752 (71.2%) women were postnatal and 304 (28.8%) were antenatal (Figure 1). The mean follow-up for postnatal women was 143 days (20 weeks) after delivery. Antenatal women were seen, on average, at 31 weeks gestation.

On EAUS, of the women who had a diagnosis of a 3a tear at delivery, 14 (2.82%) women had a full thickness defect in the EAS (Figure 2) and 23 (4.64%) women had a defect in the IAS. Of the women who had a diagnosis of a 3b tear at delivery 84 (14.84%) women had ultrasound evidence of damage to the IAS implying a 3c tear occurred (Table 3 and Figure 3). In total, 120 (11.36%) women diagnosed with a 3a or 3b tear were incorrectly classified at delivery.

Table 4 describes anorectal symptoms reported by women based on grade of tear using the SMIS. Women who had a 3b tear at delivery (mean SMIS 1.43) had a significantly higher SMIS if they were under-classified at delivery (mean SMIS 2.53) (p=0.001), indicated by the evidence of IAS injury on EAUS. However, when comparing women who had a correctly classified 3a tear (mean SMIS 1.24) and women who were under-classified at delivery (mean SMIS 0.79 and 1.3), there was no significant difference in SMIS (p=0.713).

Comparing diagnosis over two time periods (2012-2015 vs 2016-2019)] we can see that there has been some improvement in classification of OASIs (Table 5). When comparing missed IAS tears there has been a significant decrease (p=0.03), implying that there has been improved recognition of IAS tears at the time of delivery. When comparing missed complete EAS tears from 2012-2015 (n=2) and 2016-2019 (n=10) there were more missed tears in the second four-year period, but this change was not significant (p=0.06), implying that differentiating between 3a and 3b tears has not significantly changed.

**Discussion**

The main finding of this study is that 11% of women had a defect on EAUS greater than the clinical classification of OASIs made at delivery. Incorrect identification of the injury will lead to inadequate repair of the full extent of the injury, which is not without consequence. This is supported by our finding that, compared to those who were correctly classified with a 3b tear at delivery, the women who had an under-classified 3b tear had a significantly higher SMIS at follow-up, implying worse anal incontinence symptoms.

Diagnosis of perineal trauma at delivery can be challenging and examination may be limited by inadequate lighting, pain and bleeding. In addition, a thorough digital rectal and vaginal examination may not be conducted because it may be considered invasive and painful [17]. If an OASIs is suspected, the woman should be transferred to the operating theatre to ensure examination can be performed with adequate lighting and analgesia. Systematic examination, including digital rectal examination, is recommended by most national guidelines [18]. If there is uncertainty at delivery it would be best practice for another trained healthcare professional to re-examine the tear [4,19].

In our study we also found that the number of ‘missed’ full thickness EAS tears (14 women) were considerably fewer than ‘missed’ IAS tears (106 women). This is likely to be because diagnosis of a tear of the IAS can be more difficult than the EAS. On examination the EAS appears thick and dark red in colour, whilst the IAS is thin, paler (white) and its appearance could be mistaken for the mucosa [19].

Despite the under-classification, the reported mean SMIS, was low for all 3a and 3b tears, implying mild symptoms (Table 4). However, even mild symptoms can be very disruptive and significantly affect a woman’s quality of life [20]. It is important to note, given that we included pregnant and non-pregnant women, that a previous study has looked at the effect of pregnancy on SMIS and found no significant change in SMIS in women during pregnancy [16]. The significant difference found between women who had a correctly diagnosed 3b tear and those under-classified is likely to be because damage to the IAS leads to flatus incontinence and passive anal incontinence symptoms [21], contributing to the higher SMIS. However, the difference in the SMIS for 3a tears was not significant. This is likely because an intact IAS will result in a degree of continence, even if EAS function is poor.

There are two possible reasons for the under-classification of tears. Either the doctor making the diagnosis did not have good knowledge of the anatomy of the anal sphincter, or the Sultan classification [19] was not followed. The guidelines clearly state that if there is any doubt about the thickness of the EAS injury then it should be classified as a 3b tear [1,19]. For this study it must be acknowledged that all deliveries took place in the United Kingdom, predominantly in Croydon University Hospital, where classification and documentation of perineal tears is mandatory. Therefore, we may expect that classification to be well documented in our study. A very similar study to ours, also carried out in Croydon University Hospital in 2012 which analysed 3a tears only, found that 9.5% of patients were found to be under-classified when compared to EAUS findings [22]. This is similar to the 7.5% of under-classified 3a tears in our study reflecting a small improvement in classification during this time.

There are other studies that investigate the outcome of under-classified perineal tears [23,24]. Capanna et al performed 3-D transperineal scans on 119 women with a history of OASIs and found 56% of women with an IAS tear had been diagnosed at delivery as 3a or 3b tears [23]. This percentage is much higher than in our study but it was performed in Switzerland, using transperineal ultrasound, rather than EAUS, and their sample size was much smaller. The authors suggested that a combination of ultrasound and clinical examination could be used to avoid misdiagnosis of OASIs [23].

It is important to distinguish between under-classified tears and missed OASIs. A woman with an under-classified tear will have had an attempt to repair the area of injury to the anal sphincter, but a woman with a missed tear will have had no attempt at repair of the injured sphincter. This is important as it has been shown that women with missed OASIs, in comparison to those who have had a primary OASIs repair, have significantly worse faecal incontinence symptoms [10].

In a study in Italy, where transanal and transperineal ultrasound were performed in 40 women with perineal tears after delivery, 100% of the tears were under-classified. There were 40% ‘missed OASIs’, having been incorrectly classified as 2nd degree instead of a 3rd degree [24]. All the women in this study were referred for ‘obstetric rehabilitation’, implying they were symptomatic of anal incontinence and therefore were more likely to have anal sphincter trauma. These figures are very alarming and deserve investigation to audit training.

Studies that have investigated the outcome of missed OASIs should not be compared directly to our study but their findings are interesting to note. A cross-sectional study by Berg et al [25] performed EAUS on 97 women without a diagnosis of OASIs and found 9.3% of women had a missed OASIs [25]. This study also showed that SMIS scores were higher in the women with a missed OASIs [25]. Keighley et al also found high numbers of under-classified and missed OASIs (54%), identified on subsequent clinical examination, at a follow up appointment, in 81 women when they presented with anal incontinence after perineal trauma [26]. Again, this study only assessed symptomatic women, meaning they were more likely to have a tear involving the anal sphincter.

These studies raise the question over whether ultrasound at diagnosis increases the detection rate of OASIs. A Cochrane review has been completed to evaluate the use of EAUS in improving detection of OASIs following vaginal delivery [27]. However, only one study [28] comparing clinical examination to EAUS in combination with examination was identified. Although this study found an increase in the detection of full-thickness OASIs when EAUS is used, partial thickness sphincter tears were excluded from their analysis, Interestingly, a study by Wong et al found transperineal ultrasound did not significantly improve clinical detection of OASIs [29]. However, this study included all women after delivery with any grade of perineal tear, not only those with OASIs.

Ultrasound is a skill that requires specific training and expertise, especially in the immediate postpartum period [19] and there are many other factors affecting the use of ultrasound at that time, such as availability of an ultrasound machine, discomfort to the woman and ongoing bleeding. Ultimately, a sphincter defect must be clinically detectable to be able to undergo repair, therefore diagnosis must rely on clinical examination [19]. Training courses for doctors and midwives in OASIs diagnosis and repair are now more available so in this study we aimed to assess if improved training opportunities was reflected in the numbers of under-classified tears. When comparing two four-year periods of OASIs patients we found that there was an improvement in diagnosis of IAS tears (Table 5). We think that this can be attributed to an increased awareness from training undertaken by midwives and doctors.

However, given our findings, and those of other studies [23–26], there is still room for improvement. It can be suggested that further training in diagnosis and identification of OASIs may be necessary. Training in OASIs has evolved over the last 2 decades [13,14], with the introduction of mandatory courses for obstetric doctors [22], but training for midwives has more variation [3]. Therefore, to improve detection and classification of OASIs, there needs to be more intensive and mandatory training of all healthcare professionals.

The strengths of this study are that it was conducted in a large tertiary referral unit with data from a prospective database with a very large sample size. The limitations are that the interpretation of EAUS can be operator dependent [13,30]; meaning it is possible that defects in the EAS and IAS could be overestimated. However, in our series we had expert review of all EAUS images. Another possible limitation is that we relied on reports from delivery notes or referral letters from other units for the original diagnosis of OASIs, raising the possibility that tear grade at delivery could have been incorrectly documented in some cases.

**Conclusion**

Although there has been some improvement over time in classification of OASIs it appears that OASIs that are under-classified at delivery can result in an incomplete repair being completed in approximately one in ten women. We found that incorrectly classified 3b tears involving the IAS are associated with significantly worse anorectal symptoms. We hope that increased awareness and training, of doctors and midwives, in the classification of OASIs may improve detection and repair of such trauma.

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**Figure legends**

**Figure 1-** Flowchart to show included patients for analysis

**Figure 2**- Endoanal ultrasound at the superficial level. Patient was a para 1, SVD, 3a tear diagnosed at delivery. On EAUS full thickness EAS tear 11 ‘o clock to 1 ‘o clock (between arrows). Defect equivalent to 3b tear.

**Figure 3**– Endoanal ultrasound at the superficial level. Patient was a para 1, ventouse delivery, 3b tear diagnosed at delivery. Defect seen in EAS and IAS 11 ‘o clock to 1 ‘o clock (between blue lines). Defect equivalent to 3c tear.