



# Accuracy of Clinical Diagnosis of Anal Sphincter Defect: Clinical Evaluation vs. 3 Dimensional Transperineal Ultrasound

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## Abstract

**Background:** Obstetric Anal Sphincter Injuries (OASIS) are common and an important factor in the etiology of anal incontinence.

**Objective:** The objective of this study was to evaluate, classify and compare the agreement of clinically diagnosed third-degree sphincter tears with 3D-Transperineal Ultrasound (3D-TPUS) realized within 3 to 7 days post-delivery.

**Design:** This is a retrospective observational study.

**Settings:** The study examined 8779 women who delivery by vaginal way 119 (1.35%) of those had a primary repair of third-degree perineal tear.

**Patients:** 119 patients with third-degree obstetric anal sphincter tears were diagnosed and treated, 85 of those underwent a 3D-TPUS examination 3 to 7 days postpartum.

**Main outcome measures:** We compared the proportion of third-degree perineal tears, classified with the clinical examination as Grade 3a+b and Grade 3c, with the 3D-TPUS.

**Results:** In 16 patients with clinically diagnosed third-degree perineal tears Grade a and b, the ultrasound examination confirmed the lesion of the External Anal Sphincter (EAS) muscle, but in 9 patients (56% of the cases) we found a lesion of the Internal Anal Sphincter (IAS) muscle, missed by clinical examination.

In the remaining 69 patients with the third-degree perineal tears Grade c, the ultrasound examination confirmed both lesions (EAS and IAS muscles) in 56 women, but in 13 patients (19% of the cases) defects of the IAS muscle could not be confirmed by the ultrasound.

**Limitations:** Our study design did not allow detecting occult anal sphincter lesions because we did not examine an unselected group of women after vaginal delivery.

**Conclusion:** There was moderate agreement regarding diagnosis of perineal tears Grade 3a+b and Grade 3c between ultrasound and clinical examination, so a combined use of clinical and ultrasound knowledge can improve the possibility to find a gold standard in the diagnosis of OASIS.

**Keywords:** Perineum; Ultrasound; Urogynecology; Incontinence

## Abbreviations

OASIS: Obstetrics Anal Sphincter Injuries; EAS: External Anal Sphincter; IAS: Internal Anal Sphincter; 3d-TPUS: 3 Dimensional Transperineal Ultrasound; TUI: Tomographic Ultrasound Imaging

## Introduction

Obstetric Anal Sphincter Injuries (OASIS) occur in 0.4% to 7.5% of vaginal delivery and may predispose to the development of anal incontinence, whether in the immediate postpartum period or later in life [1,2]. OASIS constitutes a heterogeneous group with involvement of the anal sphincter ranging from a few superficial External Anal Sphincter (EAS) muscle fibers to involvement of the Internal Anal Sphincter (IAS) and anorectal epithelium.

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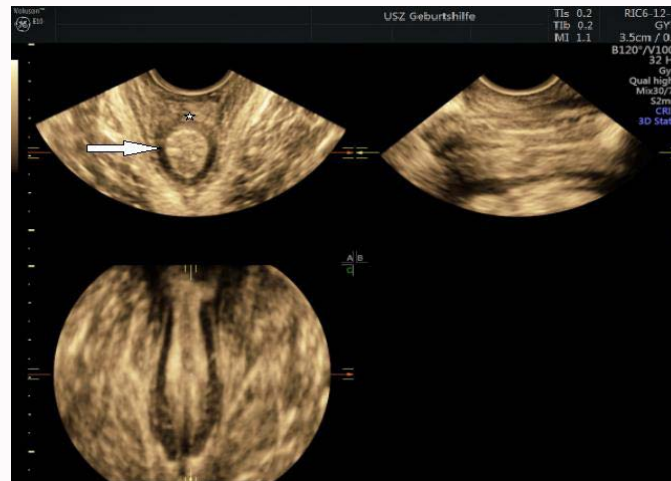
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**Figure 1:** Transperineal ultrasound images of the normal multiplanar projection of the acquired volume of the anal sphincter complex, after adjustment of the X, Y and Z planes. The internal sphincter (IAS) and external sphincter (EAS). The puborectal muscle is visualized as a U-shaped echogenic area surrounding the EAS posteriorly.

Sultan's [3] descriptive classification divides perineal tears into four grades, two of which include OASIS and depend on the degree of sphincter damage [4]. Third-degree perineal tears involve injury to the anal sphincter and are subdivided into: Grade a, having <50% of EAS thickness torn, Grade 3b, having >50% of EAS thickness torn and Grade 3c, having both EAS and IAS torn [5].

The advent of anal endosonography allows the diagnosis of clinically undiagnosed tears [1]. Tears of the anal sphincter are diagnosed clinically in up to 5% of women at the time of delivery, but ultrasound studies conducted after delivery have shown the prevalence of occult tears to anal sphincter to be as high as 35% to 41% [1,6]. Clinically undiagnosed tears are associated with subsequent anal incontinence in up to 50% of affected women [7]. Wisser [8] were the first to use the 3D-Transperineal Ultrasound (3D-TPUS) technique. They described the sonomorphology of the pelvic floor *in vivo* and shown that 3D ultrasound can be used to examine the pelvic floor anatomy after childbirth. This technique, compared with the established transrectal approach to evaluate the anal sphincter, has the advantage of examining the undescended organ in the functional setting [8,9].

## Material and Methods

The aim of this retrospective observational study, for an internal quality control, was to evaluate, classify and compare the accuracy of clinical diagnosed third-degree sphincter tears with the 3D-TPUS.

The study examined 8779 women who delivery by vaginal way. Hundred and nineteen (1.35%) of those had a primary repair of third-degree perineal tear between January 2010 and December 2015 in the department of Obstetrics, University Hospital Zurich. The repair was performed by a trained consultant in obstetrics and gynecology in the labor ward with an end-to-end technique. Patients that experienced either third/fourth degree perineal tears, as a part of the hospital's protocol, underwent a transperineal ultrasound within 3 to 7 days after delivery which was performed by the last author.

The 3D-TPUS was performed using a Voluson 730 Expert or E8 (GE Medical Systems, Kretz, Austria) with a 3D 5 MHz to 9 MHz vaginal probe, placed in the area of the fourchette. The transperineal ultrasound examination was conducted with the woman in the

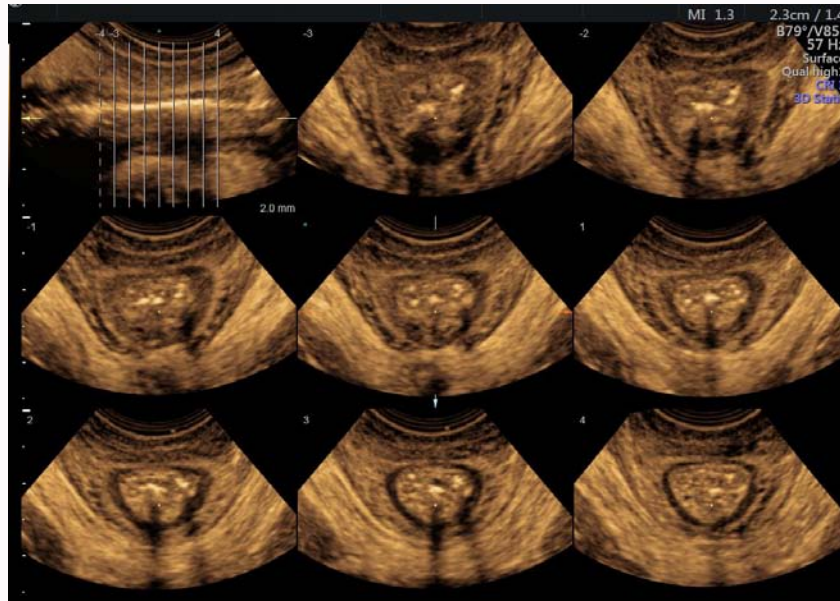
supine position (after voiding) at rest and on Pelvic Floor Muscle Contraction (PFMC), as previously described by Dietz [10]. At least one volume was obtained with the entire length of the EAS included on maximum PFMC. After the acquisition the patient was dismissed and we performed the post-processing with the transverse plane in the A-frame of the Multiplanar Projection (MPR) screen. The volumes were adjusted with the X, Y and Z plane sliders to display the transverse plane with the anal canal perpendicular to the transverse plane (Figure 1).

This volume was evaluated with Tomographic Ultrasound Imaging (TUI) (Figure 2). On TUI a set of eight slices were obtained from the level of the puborectalis loop (Slice 1) to the level of the anus (Slice 8), with a variable distance between each slice depending on the length of the EAS, leaving six slices (Slice 2 to 7) to demonstrate the entire muscle (Figure 2). A residual defect was deemed present if four out of the six slices from Slice 2 to Slice 7 showed a defect of >30°, adapted from Roos' definition using endoanal ultrasound [5,11].

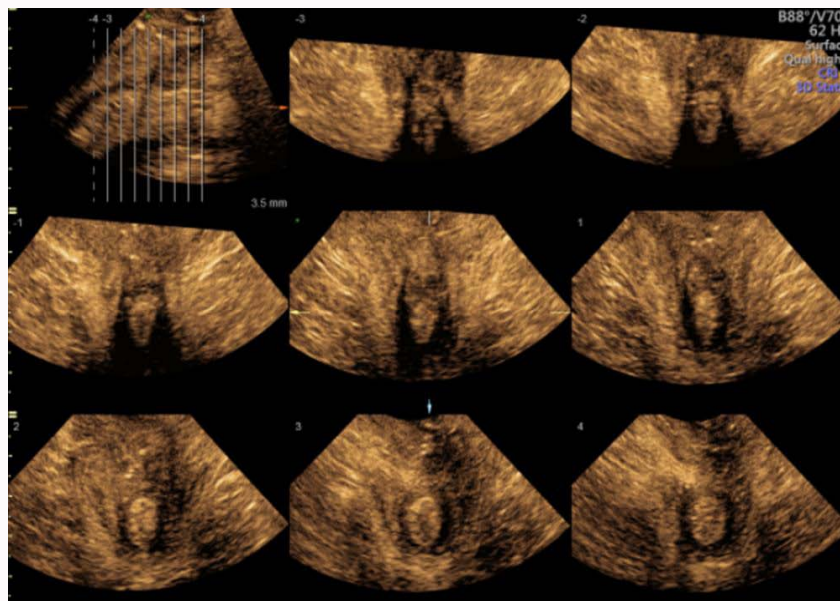
Four sonographic signs were used to indicate damage of the EAS and IAS following repair: discontinuity of the IAS and/or the EAS; changes in IAS with, particularly thickening of the IAS opposite the rupture site with thinning or interruption in the area of repair, known as the 'halfmoon' sign; thickening of the EAS in the area of repair; and changes to the rectal mucous folds, which were considered abnormal if some deviation from the symmetrical star form was observed [12,13]. Sutures were seen at ultrasound examination in all women; they appeared as bright, white spots and were located on the EAS or IAS (Figure 3 and 4).

The coronal TUI plan was used to assess the sphincter anatomy and identify the real sphincter defects from imaging artefact due to an eventual edema or hematoma that could subvert the anatomy of the anal sphincter complex (Figure 5).

Sphincter defects were evaluated and classified by the last author. A second review, blinded to all the data, was done by the first author, analyzing the stored volumes, using the proprietary software, GE Kretz 4D View version 10.0 (GE Medical Ultrasound). We compared the proportion of third-degree perineal tears, classified with the clinical examination as Grade 3a+b and Grade c, with the 3D-TPUS. For practicality the third-degree tears Grade 3a and Grade 3b were



**Figure 2:** TUI third-degree anal sphincter tear with involvement of external anal (EAS) and internal anal (IAS) muscles.



**Figure 3:** TUI Sutures after a repair of third-degree anal sphincter tear with involvement of external anal (EAS) and internal anal (IAS) muscles.

considered together as a Grade 3a+b with an involvement of EAS muscle.

After the ultrasound volumes had been analyzed, all the delivery records and the operation reports were retrieved: the woman’s parity, the gestational age at the delivery, the delivery’s modality, the average birth weight and the clinical degree of the sphincter tears.

Data were collated with Excel (2013) for Windows (Microsoft Corp., Seattle, WA, USA). Statics were performed making a comparison of proportions using MedCalc (MedCalc Software bvba, version 16.4.31993-2016). Institutional Ethical Review Committee approval was obtained for the project (2016-00184).

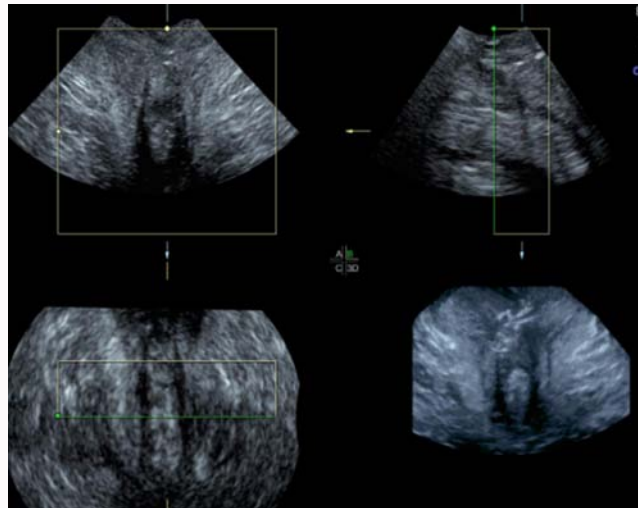
**Results**

Hundred and nine (1.35%) patients had a primary repair of third-

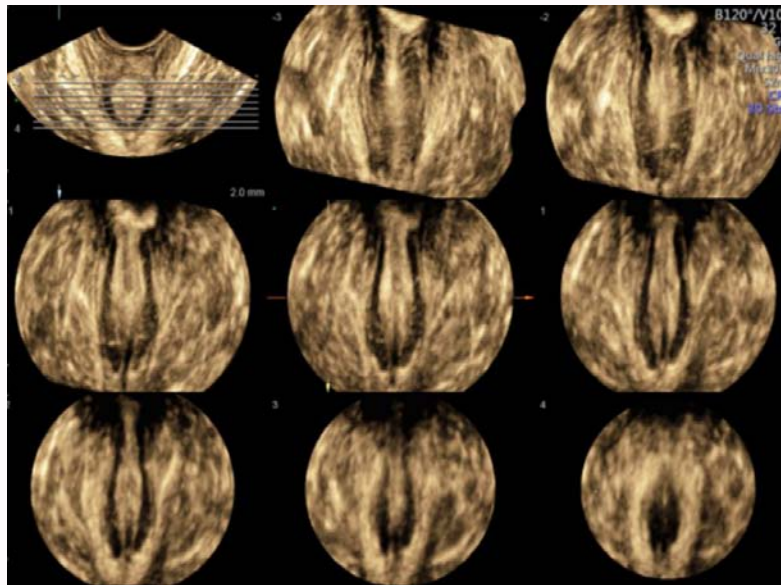
degree perineal tear. The last author performed on all the patients a 3D-TPUS and it is for this reason that we could include in the study only 85 patients (71%). We advised patients to report immediately any pain or discomfort experienced during the 3D-TPUS, in order to stop the examination, but no patient expressed any discomfort.

The mean age of the women was 31 years (range 19 to 41). Median parity was 1 (range 1 to 4), with most being primiparous (n=60, 70.5%). None of the patients had previous history of perineal tears or incontinence symptoms complaints, documented in the delivery’s records. Of those 85 patients: 53 (62.3%) delivered spontaneously, 26 (30.6%) by vacuum and 6 (7%) with Kristeller. The episiotomy was performed on 25 women (29.4%). The gestational age at delivery was 40+2 weeks (range 37+0 to 41+5) and the average birth weight was 3526 g (range 2740 g to 4650 g). Oxytocin was administered in 45 patients (53%) for achievement and progression of labor, according





**Figure 4:** Sutures after a repair of third-degree anal sphincter tear with involvement of external anal (EAS) and internal anal (IAS) muscles.



**Figure 5:** TUI in the coronal plan, assess the sphincter anatomy and discriminate the real sphincter defects from imaging artefact due to an eventual edema or hematoma, that could subvert the anatomy of the anal sphincter complex.

to Friedman's partogram [14].

The third-degree perineal tears were clinically classified as: Grade 3a in 5 patients, Grade 3b in 11 patients and Grade 3c in 69 patients.

The 3D-TPUS confirmed in the Group "Grade a+b" (16 patients) lesions of the EAS muscle, but we found in 9 (10.6% of the cases) lesions of the IAS muscle that were not diagnosed with the clinical examination (Table 1).

In the remaining 69 patients with the third-degree perineal tears Grade c, the ultrasound examination confirmed both lesions (EAS and IAS muscles) in 56 women (65.9%), but in 13 (15.3% of the cases) clinical defects of the IAS muscle could not be confirmed by the ultrasound examination (Table 1).

Out of the 69 patients that presented with Grade 3c tears we found in 13 women no involvement of the IAS muscle. Therefore, the False Positive Rate (FPR) of clinical diagnosis of anal sphincter tears is calculated 15.3%.

In cases where insufficient repair of the sphincter defect has been detected, we advised for pelvic floor reeducation. In case of clinical symptoms for anal incontinence, proctological assessment and treatment was advised within 6 months. All the patients had a pelvic floor reeducation.

## Discussion

Recognition of intrapartum anal sphincter damage is difficult and crucial for the identification of candidates for surgical repair. OASIS represents a heterogeneous group with involvement of the anal sphincter ranging from a few superficial EAS muscle fibers to involvement of the IAS muscle and anorectal epithelium [4]. Sultan's [3] descriptive classification of perineal tears, including OASIS, received widespread acceptance only recently [1,4,5]. Until now the clinical evaluation was made without any ultrasonography support, trying to recognize all the difficult structures and to categorize the lesions following the classification as reported from the RCOG [2,15]. Just after delivery, the morphological sonographic assessment of

**Table 1:** Data of third-degree perineal tears, clinical versus sonographic classification.

	Clinical diagnosis III a+b 16 Patients 7 (8.2%) Concordance	Clinical diagnosis III c 69 Patients 13 (15.3%) Discordance
3D-TPUS III a+b	9 (10.6%) Discordance	56 (65.9%) Concordance

the anal sphincter tears is important, because clinical detection and classification are sometimes difficult and therefore the diagnosis is missed [15].

Endoanal ultrasound, commonly used to evaluate the anal sphincter after childbirth, is generally considered to be the gold standard in the evaluation of fecal incontinence [11,16] and the technique has been surgically validated [6,17]. However two-dimensional (2D), three-dimensional (3D) volumetric Endovaginal Ultrasound (EVUS) and Transperineal Ultrasound (TPUS) have been proposed as alternative imaging modalities to describe anal sphincter integrity [8-13,18-21]. Although correlation with the anatomy remains to be determined, studies comparing transperineal ultrasound with endoanal ultrasound have shown moderate to good correlation between the two imaging techniques [11,22-24]. Also, a comparison of dynamic transperineal ultrasound and defecography (considered the gold standard for imaging pelvic floor pathology) show a good sensitivity and a high specificity of the ultrasound [25]. The examination of the anal sphincter anatomy using the transperineal approach may be more accessible to obstetricians, than the endoanal ultrasound, because of better availability of vaginal and curve array transducers [26,27].

To the best of our knowledge, this is the first study to evaluate, classify and compare the accuracy of clinical diagnosed third-degree sphincter tears with the 3D-TPUS.

As known the 3D-TPUS has the advantage, compared to the transrectal approach, of examining the undescended organ in the functional setting [8]. Transperineal examination with the transvaginal 3D probe was found to be acceptable to the vast majority of women, despite the fact that the exam was generally performed within the first 3 to 7 days post-partum. As reported by Timor-Tritsch [13] performing an evaluation of the sphincter a short time (1 to 3 weeks) following its repair after obstetric trauma is feasible and potentially important. Stark [27] reported that anal endosonographic imaging 2 to 7 days after primary repair of OASIS showed a high frequency (90%) of endosonographic sphincter defects. The endosonographic defects of the external sphincter seen within 7 days of a primary suture of a sphincter tear might be 'true' defects, perhaps because of inappropriate repair technique [28,29]. However, they might also be explained by postoperative hematoma or edema, or by devascularization of the external anal muscle fibers caused by sutures [27].

In the 3D-TPUS (Transversal Plan) the IAS is easy to recognize in its undescended functional setting: in fact due to its high water content, the muscle appears as hypoechoic (compared with the sub epithelial tissues and the EAS) and with a circular definite shape like a 'ring' (compared to the irregularity of an eventual edema or hematoma). The use of the coronal TUI plan is also helpful to identify the real sphincter defects from imaging artefact due to an eventual edema or hematoma that could subvert the anatomy of the anal sphincter complex.

We did not use validated questionnaires because our goal was to compare for an internal quality control the accuracy of clinical diagnosed third-degree sphincter tears with the 3D-TPUS, and not to examine women who were symptomatic only a few days after delivery. We did not perform an early second repair to the nine women (10.6%) with missed diagnosis of IAS, but they received a one-to-one intensive physiotherapy session. To all the other women they were offered a physiotherapy group session. Symptomatic women at the 6 weeks post-partum control were referred to a specific anal incontinence proctological assessment.

In our study the classification between the two methodology clinical and 3D-TPUS was discordant. The under classification of sphincter tears Grade 3a+b and the over classification of Grade 3c tears is due to the complex anatomy of the anal sphincter structures. The visual assessment of the extent of perineal trauma and the involvement of the structures are difficult due to edema and bleeding. Rectal examination can help, but does not identify the extension of the perineal lesion and whether EAS and/or IAS are involved.

The clinical value of transanal ultrasound to detect the occult sphincter lesions has been already described by Sultan [1], but we think that the use of the 3D-TPUS in the delivery rooms could be useful: To diagnose the clinically undetected IAS defects and to better classify the degree of perineal tears extension.

That will be useful not only to reduce the risk of anal incontinence later in life (with an appropriately treatment immediately after delivery), but also to reduce the surgery rate due to over-estimated ruptures, with a corresponding reduction of health care costs.

Further prospective studies are needed to ameliorate the diagnosis of sphincter defects with the 3D-TPUS in the labor ward. As previously suggested by Valsky et al. [12] we think that ultrasound assessment of the anal sphincter may serve as a screening examination for high-risk vs. low-risk groups as a part of clinical counseling prior to subsequent trial of labor or elective Cesarean section. Like them we suggest that women with evidence of damage to the anal sphincter complex, symptomatic or not, should be informed of the risk of vaginal delivery, and the option of elective Cesarean section should be seriously considered. McKenna et al. [30] estimated that 44.1% of women with a previous anal sphincter rupture would suffer persistent anal incontinence following subsequent vaginal delivery, and 2.3 elective Cesarean deliveries would be necessary to prevent one case of anal incontinence.

Several limitations of our study, however, need to be acknowledged. Unfortunately, some patients were missed, because the 3D-TPUS was performed only from one ultrasound examiner (J.W.).

Our study design did not allow detecting occult anal sphincter lesions because we did not examine an unselected group of women after vaginal delivery. Four sonographic signs were used to indicate damage of the EAS and IAS following repair [12,13]: But we did not measure the width and the length of the EAS and IAS muscles as reported by Valsky et al. [19].

## Conclusion

Anal sphincter tears are difficult to identify and to classify. In our study we could see the discordancy between the two methodologies and how difficult it is to clinically recognize the lesions of the IAS muscle fibers.

Until now the clinical diagnosis is not strong enough in order to avoid misclassification. In future we should avoid missed and false negative rates of OASIS (by identification and immediate treatment of the women with IAS and not only EAS lesions) and perform surgery only on the sonographically confirmed sphincter defects.

For visualizing this region, 3D-transperineal ultrasound has emerged as a procedure that is relatively easy to perform, cost-effective and available in all the delivery rooms. Further studies are necessary to assess the power of the 3D-TPUS in order to help the clinician in such a difficult anatomic area. There is no doubt that a combined use of clinical and ultrasound knowledge can improve the probability to find a gold standard in the diagnosis of obstetric anal sphincter injuries.

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