

4

Third and Fourth Degree Tears

Abdul H. Sultan and Raneer Thakar

4.1 Historical Perspective

The earliest evidence of severe perineal injury sustained during childbirth is from the mummy of Henhenit, an Egyptian woman approximately 22 years of age from the harem of King Mentuhotep II of Egypt in 2050 BC.¹ Henhenit's pelvis was an abnormal shape, there was a rupture of the vagina into the bladder and the lower bowel was found protruding from the anus. These severe perineal injuries may have been due to cephalo-pelvic disproportion that probably resulted in her early death.¹

The first mention of the surgical management of severe perineal injury appears in Avicenna's famous Arabic book, *AlKanoun*. He recommended a form of a crossed or bootlace suture for the repairs of perineal injuries. Celsus offered only bedrest with legs secured together. However, Ambroise Pare, Mauriceau and Smellie disagreed with this approach and recommended the use of sutures, although there is no evidence that they actually did use sutures. The first recorded case of perineal suture was by Guillemiau around 1610, when he attempted to repair a fourth degree tear using a suture twisted around a straight needle, but this was unsuccessful.¹ In 1834, Roux described a technique of approximating the torn edges with a quilted suture reinforced by interrupted sutures.¹ Subsequently there have been various reports in which material such as carbolic catgut, silk, silk-worm gut and silver wire were used for suturing. However, success rates with primary wound union of perineal wounds reported in the late 1800s were in the region of 50–60%.²

In 1930, Royston³ described a commonly practised technique in which the ends of the torn sphincter were approximated by inserting a deep catgut suture through the inner third of the sphincter muscle and a second set of sutures (mattress or interrupted) through the outer third of the sphincter. As early as 1948, Kaltreider⁴ described their series of women since 1935 in whom one mattress or figure-of-eight suture was used to approximate the sphincter ends during primary repair.

Ingraham et al.⁵ mentioned the Royston technique as their method of repair, but their description differs in that they indicate that sutures are only inserted in the fascial sheath or capsule of the anal sphincter. Fulsher and Fearl⁶ also described this technique and emphasised that no sutures should pass through the sphincter muscle. More specifically, Cunningham and Pilkington⁷ described inserting four interrupted sutures in the capsule of the external anal sphincter (EAS) at the anterior, posterior, superior and inferior points. The end-to-end approximation type of repair has been the standard and is still used widely. However, in 1999, Sultan et al.⁸ described the overlap technique of primary repair of the EAS (described by Parks previously for secondary sphincter repair). In addition, Sultan et al.⁸ highlighted the importance of recognition and separate repair of the freshly torn internal anal sphincter (IAS), which is largely responsible for maintaining the resting tone of the anal sphincter. Damage to the IAS is associated with incontinence to flatus and passive soiling (see Chapter 8).

4.2 Prevalence

The prevalence of third and fourth degree tears, collectively referred to as obstetric anal sphincter injuries (OASIS), appears to be dependent upon the type of episiotomy practised. In centres where mediolateral episiotomies are practised, the rate of OASIS is 1.7% (2.9% in primiparae)⁹ compared to 12%¹⁰ (19% in primiparae)¹¹ in centres practising midline episiotomy.

4.3 Outcome of Primary Repair

A meta-analysis of the literature regarding the outcome of primary repair is difficult to establish due to considerable variability in study design and data collection. There are variations in repair techniques (anaesthesia used, suture material, repair, antibiotics, stool softeners), some studies are multicentre,¹² there is a wide range of follow-up periods and discrepancies exist in subjective and objective assessments. In particular, most studies have used non-validated structured questionnaires, while others^{12,13} have used scoring systems, e.g. Pescatori, Wexner. Given these limitations, we have attempted to compile a list of studies in the English literature following a Medline search from January 1980 to December 2005 (Table 4.1).

The extent of the sphincter injury may be related to outcome of repair. However, in some studies, the data were not interpretable,²⁰ incomplete^{28,44} or inclusive of symptoms other than anal incontinence.³⁷ Nazir et al.⁴¹ evaluated 132 females with OASIS and found that on univariate analysis, the grade of tear correlated with frequency of soiling, but this was no longer statistically significant on multivariate analysis. In Table 4.2 we have included studies that have quantified the degree of sphincter trauma and correlated it with anal incontinence. De Leeuw et al.²⁶ reported that the odds for the development of faecal incontinence increased more than twofold with each grade ($4 > 3b > 3a$).

Thirty-five studies were identified over a 20-year period with follow-up ranging from 1 to 30 months. The prevalence of anal incontinence (including flatus as a sole symptom) and faecal incontinence (liquids and solids with or without

flatus) following end-to-end repair ranges between 15–61% ($n = 35$; mean = 39%) and 2–29% ($n = 25$; mean = 14%) respectively (Table 4.1). In addition faecal urgency can affect a further 6^{30,44}–28%.⁴⁶ Despite repair, persistent sonographic anal sphincter defects were identified in 34²¹–91%.⁴⁴ Another distressing symptom following OASIS that is not frequently volunteered because of embarrassment is the development of anal incontinence during coitus, affecting about 17% of women.⁴² Forceps delivery, first vaginal delivery, large baby, shoulder dystocia and a persistent occipito-posterior position have been identified as the main risk factors for the development of a third/fourth degree tear.^{26,29,30,47}

4.4 Repair Techniques

For decades the most popular technique of primary repair following OASIS has been by “end-to-end” approximation with either interrupted or “figure-of-eight” sutures (Figure 4.1).³⁰ By contrast, when faced with patients with faecal incontinence, colorectal and trained gynaecologic surgeons favour the “overlap technique” of sphincter repair (secondary) as described by Parks and McPartlin.⁴⁸ (see Chapter 12A). Jorge and Wexner⁴⁹ reviewed the literature and reported on 21 studies using the overlap technique, with good results ranging from 74% to 100%. Unfortunately, as already alluded to above, there are similar limitations in performing a meta-analysis to look at outcomes regarding studies relating to secondary sphincter repair (see Chapter 12A). Engel et al.⁵⁰ prospectively studied 55 patients with faecal incontinence undergoing overlap anterior anal sphincter repair and reported a good clinical outcome in 80% at 15 months. A poor result was found to be associated with an EAS defect, while demonstration of an overlap by anal endosonography (Figure 4.2) correlated with a favourable outcome. At 5-years, 46 of the 55 patients were followed up and only 50% remained continent.⁵¹ However, at least one third of these women had more than one attempt at sphincter repair.⁵¹

Despite scepticism from surgeons that overlapping friable torn muscle as a primary procedure may not be possible, Sultan et al.⁸ evaluated the

TABLE 4.1. Prevalence of anal incontinence following primary repair of obstetric anal sphincter rupture (faecal incontinence only, i.e. excluding flatus incontinence, is shown in parentheses).

Author (<i>n</i> = 33)	Year	Country	<i>N</i>	Follow-up (months)	Anal(faecal) incontinence
Sangalli et al. ¹⁴	2000	Switzerland	177	13 years	15% (10%)
Wood et al. ¹⁵	1998	Australia	84	31	17%* (7%)
Walsh et al. ¹⁶	1996	UK	81	3	20% (7%)
Sander et al. ¹⁷	1999	Denmark	48	1	21% (4%)
Pretlove et al. ¹⁸	2004	UK	41	?	22% (22%)
Crawford et al. ¹⁹	1993	USA	35	12	23% (6%)
Sorensen et al. ²⁰	1993	Denmark	38	3	24% (?)
Mackenzie et al. ²¹	2003	UK	53	3	25% (7%)
Nichols et al. ²²	2005	USA	56	3	25% (11%)
Nielsen et al. ²³	1992	Denmark	24	12	29% (?)
Go and Dunselman ²⁴	1988	Netherlands	20	6	30% (15%)
Fenner et al. ²⁵	2003	USA	165	6	30% (?)
De Leeuw et al. ²⁶	2001	Netherlands	125	14 years	31% (?)
Wagenius ²⁷	2003	Sweden	186	4 years	33% (25%)
Fornell et al. ²⁸	1996	Sweden	51	6	40% (16%)
Poen et al. ²⁹	1998	Netherlands	117	56	40% (?)
Sultan et al. ³⁰	1994	UK	34	2	41% (9%)
Zetterstrom et al. ³¹	1999	Sweden	46	9	41% (2%)
Mellerup Sorensen et al. ³²	1988	Denmark	25	78	42% (?)
Tetzschner et al. ³³	1996	Denmark	72	24–48	42% (17%)
Williams et al. ³⁴	2003	UK	124	?	42% (?)
Norderval et al. ¹²	2004	Norway	156	25	42% (17%)
Garcia et al. ³⁵	2005	USA	26	3	42% (15%)
Kammerer-Doak et al. ³⁶	1999	USA	15	4	43% (13%)
Haadem et al. ³⁷	1988	Sweden	62	3	44% (?)
Rieger et al. ³⁸	2004	Australia	51	3	45% (25%)
Bek and Laurberg ³⁹	1992	Denmark	121	?	50% (?)
Davis et al. ⁴⁰	2003	UK	52	3.6	50% (?)
Fitzpatrick et al. ¹³	2000	Ireland	154	3	53% (6%)
Nazir et al. ⁴¹	2003	Norway	100	18	54% (17%)
Gjessing et al. ⁴²	1998	Norway	35	12–60	57% (23%)
Savoye-Collet et al. ⁴³	2003	France	21	4	57% (29%)
Goffeng et al. ⁴⁴	1998	Sweden	27	12	59% (11%)
Nygaard et al. ⁴⁵	1997	USA	29	30 years	59% (28%)
Pinta et al. ⁴⁶	2004	Finland	52	15	61% (10%)
Mean					39% (14%)

*Includes two with secondary sphincter repair.

TABLE 4.2. Rates of incontinence according to grade of tear.

Author	Year	<i>N</i>	3a	3b	4°	<i>P</i> value
Poen et al. ²⁹	1998	117		38%	58%	NS
Sangali et al. ¹⁴	2000	177		11.5%	25%	0.049
De Leeuw et al. ²⁶	2001	125	21%	31%	64%	0.001
Fenner et al. ²⁵	2003	165		3.6%	31%	0.001
Norderval et al. ¹²	2004	156	44%	44%	53%	NS*
Nichols et al. ²²	2005	56		28%	59%	0.03
Mean				22%	48%	

In these studies, 3a = partial thickness, 3b = full thickness, 4° = torn anal sphincter and mucosa. *3a and 3b were combined for the analysis.

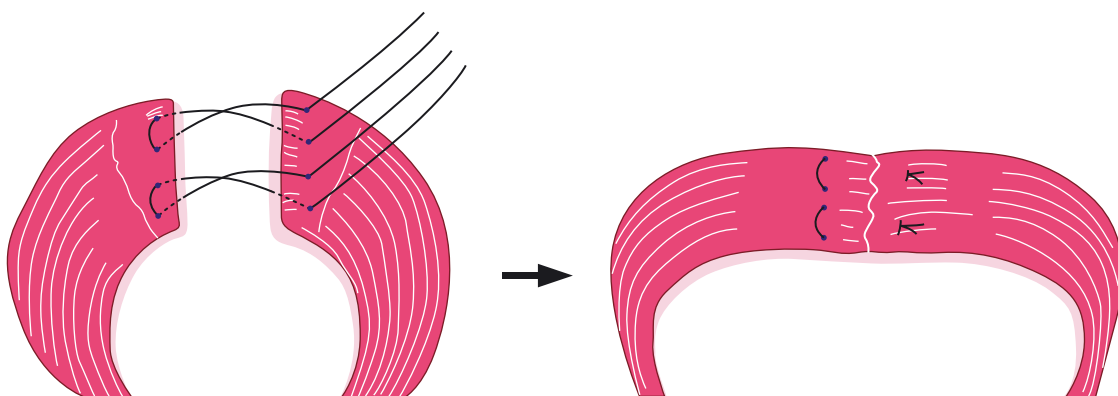


FIGURE 4.1. Diagrammatic representation of an end-to-end repair using "figure-of-eight" sutures.

feasibility of this technique in 27 women and demonstrated that EAS overlap repair as well as identification and end-to-end repair of the IAS was possible following acute OASIS. They observed that compared to matched historical controls⁵² who had an end-to-end repair, anal incontinence could be reduced from 41% to 8% using the overlap technique and separate repair of the internal sphincter.⁸ Based on this they recommended a randomised trial between end-to-end and overlap repair.

Kairaluoma et al.⁵³ reported on 31 consecutive women who sustained OASIS (3b and fourth

degree). All had an EAS overlap repair immediately after delivery performed by two colorectal surgeons. In addition to end-to-end repair of the IAS, they also performed a levatorplasty to approximate the levators in the midline with two sutures. At a median follow-up of 2 years, 23% complained of anal incontinence, 23% developed wound infection, 27% complained of dyspareunia and one developed a rectovaginal fistula. Levatorplasty therefore should be avoided during primary anal sphincter repair.

The first published randomised trial published was by Fitzpatrick et al.¹³ in Dublin, who found no significant difference between the two methods of repair, although there appeared to be trend towards more symptoms in the end-to-end group. There were methodological differences in that the torn IAS was not identified and repaired separately and they used a constipating agent for 3 days after the repair. Unfortunately they included partial EAS tears in their randomised study. A true overlap^{8,48} is not possible if the sphincter ends are not completely divided and it would be expected that if an overlap is attempted, the residual intact sphincter muscle would have to curl up and hence there would be undue tension on the remaining torn ends of muscle that would be overlapped. This technique would therefore go against the general principles of surgery of deliberately placing tissue under avoidable tension. Nevertheless as the authors concur, a better outcome would be expected with both techniques as a consequence of focused education and training in anal sphincter repair.

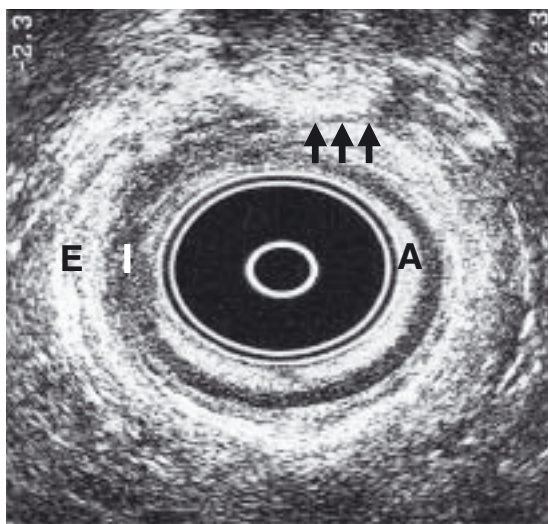


FIGURE 4.2. Endoanal ultrasound image (E external sphincter, I internal sphincter, A anal epithelium) with arrows indicating site of overlap repair of the external anal sphincter.

Garcia et al.³⁵ also performed a randomised trial of the two techniques and took great care to include only complete ruptures of the EAS (full-thickness 3b, 3c and fourth degree tears). There were 23 women in the end-to-end group and 18 in the overlap group. Unfortunately only 15 and 11 women respectively returned for follow-up, which was only at 3 months. No significant difference was found between the groups in terms of symptoms of faecal incontinence or transperineal ultrasound findings. However, the authors acknowledged that the major limitations of their study were that randomisation was inaccurate and that their study was underpowered.

Recently, Williams et al.⁵⁴ performed a factorial randomised controlled trial ($n = 112$) in which women were randomised into four groups: overlap with polyglactin (Vicryl; Ethicon, Edinburgh, UK); end-to-end repair with Vicryl; overlap repair with polydioxanone (PDS; Ethicon, Edinburgh, UK); end-to-end repair with PDS. This trial was specifically designed to test the hypothesis regarding suture-related morbidity (need for suture removal due to pain, suture migration or dyspareunia) using the two techniques. At 6 weeks there were no differences in suture-related morbidity. The authors claim that there were no differences in outcome based on repair technique. Unfortunately, the majority of patients included in this trial had partial tears of the EAS (3a tears) and as mentioned above, a true overlap^{8,48} cannot be performed if the EAS is only partially torn. Furthermore, their follow-up rate at 12 months was only 54%. These data therefore need to be interpreted with caution.

Fernando et al.⁵⁵ performed a randomised trial of end-to-end vs overlap technique.⁸ The study had adequate power ($n = 64$) and the primary outcome was faecal incontinence at 1 year. All repairs were performed by two trained operators and superficial partial tears of the EAS (3a) were excluded. At 12 months (81% follow-up rate), 24% in the end-to-end and none in the overlap group reported faecal incontinence ($P = 0.009$). Faecal urgency at 12 months was reported by 32% in the end-to-end group and 3.7% in the overlap group ($P = 0.02$). There were no significant differences in dyspareunia and quality of life between the groups. At 12 months, 20% reported perineal pain in the end-to-end group and none in the overlap group

($P = 0.04$). During 12 months, 16% in the end-to-end group and none in the overlap group reported deterioration of defaecatory symptoms ($P = 0.01$). Further calculation revealed that four women need to be treated with the overlap technique to prevent one woman with OASIS developing faecal incontinence.

4.5 Principles and Technique of Repair

1. Repair of OASIS should be conducted only by a doctor who has been formally trained (or under supervision) in primary anal sphincter repair.

2. Repair should be conducted in the operating theatre where there is access to good lighting, appropriate equipment and aseptic conditions. In our unit we have a specially prepared instrument tray containing a Weislander self-retaining retractor, four Allis tissue forceps, McIndoe scissors, tooth forceps, four artery forceps, stitch scissors and a needle holder (www.perineum.net). In addition, deep retractors (e.g. Deavers) are useful when there are associated paravaginal tears.

3. A general or regional (spinal, epidural, caudal) anaesthetic provides analgesia as well as muscle relaxation, which is an important pre-requisite to enable proper evaluation of the full extent of the injury. As the inherent tone of the EAS can result in retraction of the torn muscle ends within its capsular sheath, adequate muscle relaxation would allow the torn ends of the EAS to be grasped and retrieved. This would enable repair of the torn muscles without tension, especially if the intention is to overlap the EAS.

4. The full extent of the injury should be evaluated by a careful vaginal and rectal examination in lithotomy and graded according to the recommended classification (see Chapter 2). If there is any ambiguity about the grading of the injury, the next higher grade should be selected, e.g. if there is a discrepancy between grade 3a and 3b, the injury should be classified as 3b.

5. On rare occasions an isolated "buttonhole" type tear (see Chapter 2) can occur in the rectum without disrupting the anal sphincter. This is best repaired transvaginally using interrupted Vicryl sutures. To minimise the risk of a persistent

rectovaginal fistula, a second layer of tissue should be interposed between the rectum and vagina by approximating the rectovaginal fascia. A colostomy is rarely indicated unless there is a large tear extending above the pelvic floor or there is gross faecal contamination of the wound.

6. In the presence of a fourth degree tear, the torn anal epithelium is repaired with interrupted Vicryl 3/0 sutures with the knots tied in the anal lumen. This technique has been widely described⁵⁶ and proponents of this technique argue that by tying the knots outside, the quantity of foreign body within the tissue would be reduced, hence reducing the risk of infection. However, this concern probably applies to the use of catgut, which dissolves by proteolysis, as opposed to the newer synthetic materials such as Vicryl or Dexon (polyglycolic acid), which dissolve by hydrolysis. Catgut made from submucosa of sheep gastrointestinal tract has now been withdrawn from the UK and other European countries. A subcuticular repair of the anal epithelium via the transvaginal approach has also been described and could be equally effective provided the terminal knots are secure.⁵⁶

7. The sphincter muscles are repaired with 3/0 PDS dyed sutures (Figure 4.3). Compared to a braided suture material, monofilamentous sutures are believed to lessen the risk of infection.⁵⁷ Non-absorbable monofilament sutures such as nylon or Prolene (polypropylene) are preferred by some colorectal surgeons when performing secondary sphincter repair. However, non-absorbable sutures

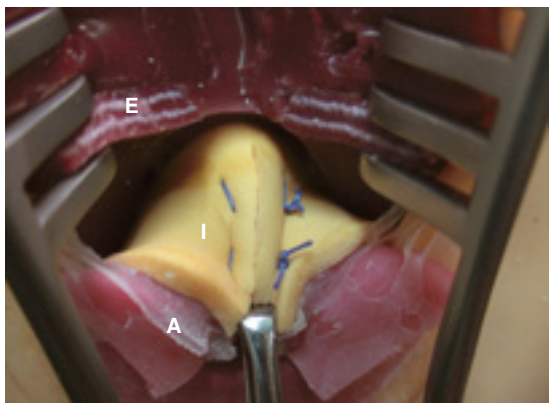


FIGURE 4.3. Internal anal sphincter (I) repair using mattress sutures demonstrated on a model (E external sphincter, A anal epithelium).

can cause stitch abscesses (particularly the knots) and the sharp ends of the suture can cause discomfort, necessitating removal. Complete absorption of PDS takes longer than Vicryl, with 50% tensile strength lasting more than 3 months compared to 3 weeks respectively.⁵⁴ To minimise suture migration, care should be taken to cut suture ends short and ensure that they are covered by the overlying superficial perineal muscles. However, a randomised controlled trial revealed no differences in suture-related morbidity between Vicryl and PDS at 6 weeks postpartum.⁵⁴

8. The IAS should be identified and, if torn, repaired separately from the EAS. The IAS lies between the EAS and the anal epithelium. It is thinner and paler than the striated EAS (see Chapter 2). The appearance of the IAS can be described as being analogous to the flesh of raw fish, as opposed to the red meat appearance of the EAS. The ends of the torn muscle are grasped with Allis forceps and an end-to-end repair is performed with interrupted or mattress 3/0 PDS sutures (Figure 4.3). A torn IAS should be approximated with interrupted sutures, as overlapping can be technically difficult. There is some evidence that repair of an isolated IAS defect is beneficial in patients with established anal incontinence.⁵⁸ In a recent blinded randomised study of repair after OASIS, all nine women who had a repair of an IAS tear (grade 3c or fourth degree) were found to have an intact IAS at follow-up using anal endosonography.⁵⁵

9. As the EAS is normally under tonic contraction, it tends to retract when torn (Figure 4.4). The torn ends of the EAS therefore need to be identified and grasped with Allis tissue forceps (Figure 4.5). In order to perform an overlap, the muscle may need mobilisation by dissection with a pair of McIndoe scissors separating it from the ischio-anal fat laterally. The torn ends of the EAS can then be overlapped in a “double-breasted” fashion (Figure 4.6) using PDS 3/0 (Ethicon) sutures. A proper overlap is possible only when the full length of the torn ends of the EAS is identified (Figure 4.7); overlapping allows for a greater surface area of contact between muscle (Figure 4.6). By contrast, an end-to-end repair can be performed without identifying the full length of the EAS, giving rise to incomplete apposition (Figure 4.8). Consequently, the woman may remain

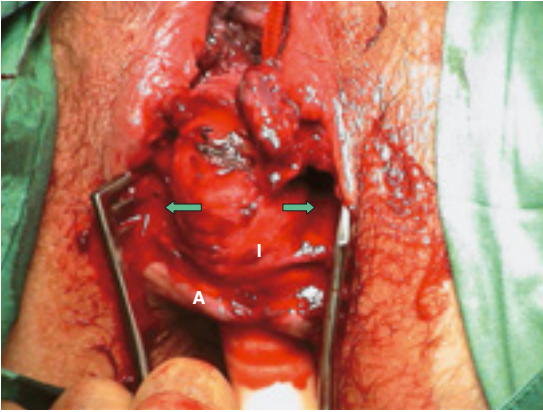


FIGURE 4.4. Third degree tear (grade 3c) with arrows demonstrating retraction of the external sphincter. The internal sphincter (I) is also partially torn and the anal epithelium (A) is intact.

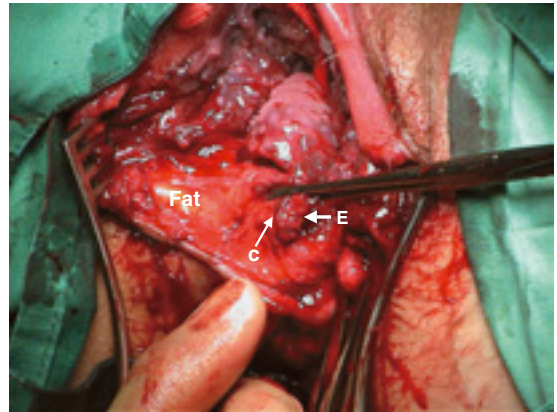


FIGURE 4.5. The external sphincter (E) grasped with Allis forceps is surrounded by the capsule (C) and lies medial to the ischio-anal fat.

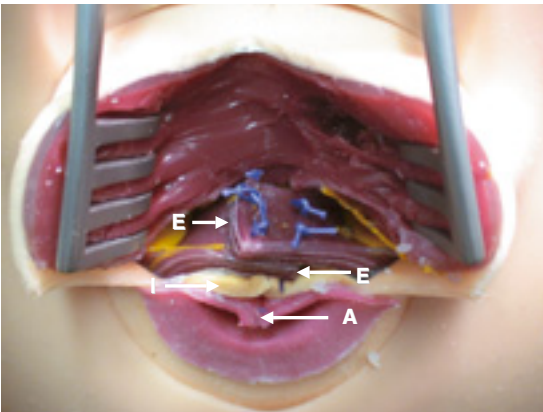


FIGURE 4.6. Repair of a fourth degree tear (demonstrated on a model) using the overlap repair technique of the external sphincter (E). The anal epithelium (A) and the internal sphincter (I) have also been repaired.



FIGURE 4.7. The full length of the external sphincter should be identified before repair is attempted.

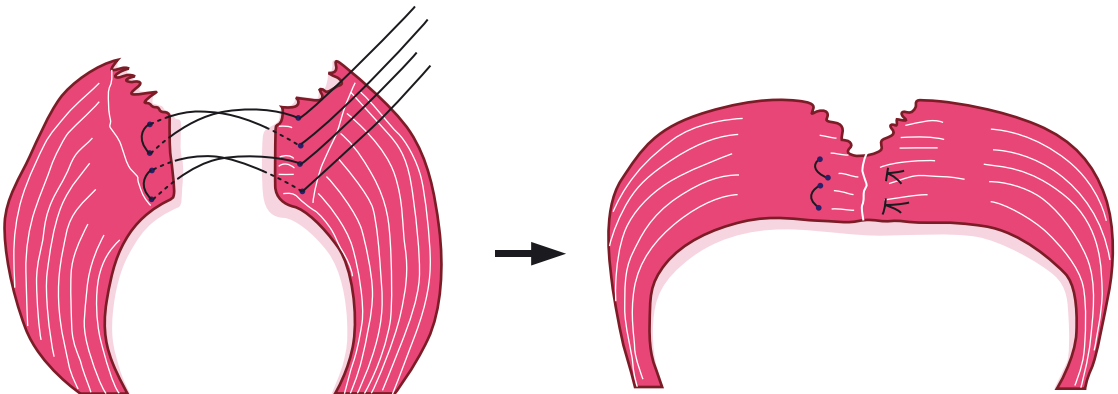


FIGURE 4.8. If the full length of the EAS is not exposed (Figure 4.7), apposition may be incomplete, leading to functional compromise.

continent but would be at an increased risk of developing incontinence later in life. A shorter anal length has been reported following end-to-end primary repair of the EAS.³⁰ It has also been shown that a shorter anal length is the best predictor of faecal incontinence following secondary sphincter surgery.⁵⁹ Unlike end-to-end repair, if further retraction of the overlapped muscle ends were to occur, it is highly probable that muscle continuity would be maintained. However, if the operator is not familiar with the overlap technique or if the EAS is only partially torn (grade 3a/3b), an end-to-end repair should be performed using two or three mattress sutures similar to IAS repair (Figure 4.9) instead of haemostatic “figure-of-eight” sutures (Figure 4.1).

10. After repair of the sphincter, the perineal muscles should be sutured to reconstruct the perineal body to provide support to the repaired anal sphincter. Furthermore, a short deficient perineum would make the anal sphincter more vulnerable to trauma during a subsequent vaginal delivery. Finally, the vaginal skin should be sutured and the perineal skin approximated with a Vicryl 3/0 subcuticular suture.

11. A rectovaginal examination should be performed to confirm complete repair and ensure that all tampons or swabs have been removed.

12. Detailed notes should be made of the findings and repair. Completion of a pre-designed proforma and a pictorial representation of the tears prove very useful when notes are being

reviewed following complications, audit or litigation (Figure 4.10).

4.6 Postoperative Management

4.6.1 Antibiotics

There are no randomised trials to substantiate the benefits of intraoperative and postoperative antibiotics following repair of OASIS. However, they are now commonly prescribed⁶⁰ (especially with fourth degree tears),⁵⁶ as infection and wound breakdown could jeopardise the outcome of repair and lead to incontinence or fistula formation. We prescribe intravenous broad-spectrum antibiotics such as cefuroxime 1.5g and metronidazole 500mg intraoperatively and continue this orally for 5–7 days.

4.6.2 Bladder Catheterisation

Severe perineal discomfort, particularly following instrumental delivery, is a known cause of urinary retention and following regional anaesthesia it can take up to 12 hours before bladder sensation returns. A Foley catheter should be inserted for about 24 hours unless midwifery staff can ensure that spontaneous voiding occurs at least every 3–4 hours without undue bladder overdistension.

4.6.3 Postoperative Analgesia

The degree of pain following perineal trauma is related to the extent of the injury and OASIS are frequently associated with other more extensive injuries such as paravaginal tears. In one study, 91% of women still complained of severe perineal pain 7 days after OASIS.⁶¹ In a systematic review, Hedayati et al.⁶² found that rectal analgesia such as diclofenac is effective in reducing pain from perineal trauma within the first 24 hours after birth and women used less additional analgesia within the first 48 hours after birth (see Chapter 6). Diclofenac is almost completely protein bound and therefore excretion in breast milk is negligible.⁶³ In women who have had a repair of a fourth degree tear, diclofenac should be administered orally, as insertion of suppositories may be

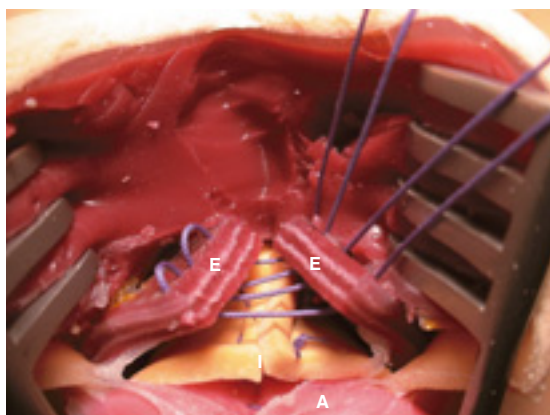


FIGURE 4.9. End-to-end repair of the external sphincter (E) using two mattress sutures (I internal sphincter, A anal epithelium).

DETAILS OF PERINEAL TRAUMA REPAIR ____ Mayday University Hospital

Patient Name: Number: Date:.....

Tick type of perineal trauma **First degree** ☐ **Second degree** ☐

Third degree ☐, if third degree please specify 3a / 3b /3c **Fourth degree** ☐

Episiotomy ☐ If yes, Please state indication.....

Extent of trauma **tick ALL relevant boxes)** **Unilateral vaginal tear** ☐ **Bilateral vaginal tear** ☐

Labial trauma ☐ **Perineal skin edges down to anal margin**

Anaesthetic for repair **None** ☐ **Epidural** ☐ **Spinal** ☐ **Lignocaine** ☐ _____ mls

Repair details

Time of delivery **Time repair commenced** **Time repair finished**

Method of repair

Vagina	Interrupted / Continuous	Suture used Vicryl / Vicryl Rapide
Perineal muscles	Interrupted / Continuous	Suture used Vicryl / Vicryl Rapide
Perineal skin	Interrupted / Continuous	Suture used Vicryl / Vicryl Rapide
Anal mucosa	Interrupted / Continuous	Suture used Vicryl / Vicryl Rapide
Internal anal sphincter	Interrupted / Mattress	Suture used PDS / Vicryl
External anal sphincter	Overlap / End to end	Suture used PDS / Vicryl

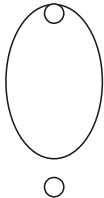
Additional information
.....

Please complete diagram, mark lacerations and suture repair

Urethra →→→

Vagina →→

Anal sphincter →→→



Rectal examination done before repair **Yes / No** Rectal examination done after repair **Yes / No**

Vaginal examination done **Yes / No** Tampon Removed **Yes / No**

Needle count correct **Yes / No** Swab count correct **Yes / No**

Estimated blood loss **After delivery** mls **After suturing** mls **Total** mls

Repaired by
(Print Name) **Midwife / Doctor**
If midwife: grade If doctor: Consultant / Staff Grade / SpR /
SHO

FIGURE 4.10. Proforma used at Mayday University Hospital for documentation of perineal trauma.

uncomfortable and there is a theoretical risk of poor healing associated with local anti-inflammatory agents. Codeine-based preparations are best avoided, as they may cause constipation, leading to excessive straining and possible disruption of the repair.

4.6.4 Dietary Advice and Stool Softeners

It is of utmost importance that constipation is avoided, as passage of constipated stool or indeed faecal impaction requiring manual evacuation may disrupt the repair. Although there are

conflicting practices described in the literature, the majority consensus is that stool softeners should be prescribed.⁵⁶ Mahony et al.⁶⁴ performed a randomised trial ($n = 105$) of constipating versus laxative regimens and found that use of laxatives was associated with a significantly earlier and less painful first bowel motion as well as earlier discharge from hospital. Nineteen per cent in the constipated regimen group experienced troublesome constipation (two required hospital admission for faecal impaction) compared to 5% in the laxative regimen group. There were no significant differences in continence scores, anal manometry or endoanal scan findings.

Another prospective, randomised surgeon-blinded study⁶⁵ of patients undergoing anorectal reconstructive surgery ($n = 46$) reported a faecal impaction rate of 26% in the group given constipating agents till the third postoperative day compared to 7% in the group allowed a regular diet. We therefore prescribe stool softeners (lactulose 15 ml bd) and a bulking agent (Fybogel [ispaghula husk], one sachet bd) for 10–14 days and we have not encountered any problem with bowel evacuation using this regimen.⁸ We prefer not to discharge women from hospital until a bowel action has occurred, unless the community midwife can ensure that constipation is avoided. In the USA, this practice may not be possible since most patients will be discharged within 24 hours following a vaginal delivery. It is recommended that women with OASIS see a healthcare provider 24 or 48 hours after hospital discharge to ensure that bowel evacuation has occurred. If not, early intervention with lactulose, mineral oil, milk of magnesia or other oral bowel stimulant should be given in addition to the stool softeners and bulking agent as described above.

4.6.5 Patient Information

Williams et al.⁶⁶ performed a qualitative study of six women who sustained OASIS, and four who had a subsequent pregnancy after OASIS. Some of the themes identified in these women were: apprehension about the consequences of the injury in terms of incontinence, body image and sexual functioning, poor communication and emotional support and unresolved anxieties in partners.

Ideally, these women should be under the care of a specialist team who run the perineal clinic (see Chapter 6). The perineal clinic is viewed as a supportive environment and women feel confident about the information provided by the team.⁶⁶ We provide an information booklet to these women to ensure that they understand the implications of sustaining OASIS and secondly provide information as to where and when to seek help if symptoms of infection or incontinence develop. All women complete a validated bowel health and quality-of-life questionnaire relating to issues before the delivery. Following discharge from hospital they should have open access to this clinic until their postnatal appointment, usually between 6 to 8 weeks after delivery. We recommend that pelvic floor and anal sphincter exercises can be initiated when the discomfort resolves and the woman feels comfortable.

If a perineal clinic is not available, women with OASIS should be given clear instructions, preferably in writing before leaving the hospital. In the first 6 weeks following delivery, they should look for signs of infection or wound dehiscence and call with any increase in pain or swelling, rectal bleeding, or purulent discharge. Any incontinence of stool or flatus should also be reported.

4.6.6 Follow-up

We recommend that all women who sustain OASIS should be assessed in hospital by a senior obstetrician 6–8 weeks after delivery. In our practice all women who sustained OASIS are seen usually with their partners in the dedicated perineal clinic (see Chapter 6). They complete the same questionnaires as they did before discharge from hospital. A genital examination is performed, looking specifically for scarring, residual granulation tissue and tenderness. All women then undergo anal manometry and endosonography (see Chapters 9 and 10). We ensure that they understand the circumstances surrounding the delivery and provide an explanation if there are concerns. The women are advised to continue pelvic floor exercises while others with minimal sphincter contractility may need electrical stimulation (see Chapter 11).

4.7 Management of Subsequent Pregnancies

Women who sustain anal sphincter injury need careful counselling regarding their management in a subsequent pregnancy. They feel very vulnerable following a previous traumatic delivery and often find the advice inconsistent and biased towards caesarean section (CS).⁶⁶ In one survey,⁶⁰ 71% of colorectal surgeons recommended CS (a further 19% admitted they were uncertain) compared to fewer than 22% of obstetricians who recommended CS. Unfortunately, the data currently available to develop evidence-based guidelines are limited and therefore we have to rely largely on recommended practice. There are two major issues that concern most women following OASIS when contemplating delivery in a subsequent pregnancy: namely, the risk of recurrence and the risk of developing anal incontinence.

4.7.1 What Is the Risk of Recurrence of OASIS?

The risk of recurrence is dependent upon the type of episiotomy practised in any unit. Most of the published studies are in centres practising midline episiotomy.^{11,67}

Peleg et al.¹¹ studied 4,015 consecutive primiparae who had a singleton, cephalic presentation at term and found 704 sustained OASIS (19%). The risk of recurrence of OASIS in these women was 2.1% when no episiotomy was performed, 11% when a midline episiotomy was performed and 21% when a midline episiotomy was accompanied by instrumental delivery. In another study where midline episiotomies were practised, the recurrence rate of OASIS was reported to be 11%.⁶⁷ Harkin et al.⁹ studied 20,111 consecutive vaginal deliveries in a unit that practises only mediolateral episiotomies and OASIS occurred in 342 women (2.9% in primiparae and 0.8% in multiparae). Obstetric anal sphincter injuries recurred in two (4.4%) of the 45 women who had sustained OASIS previously. Although risk of OASIS was increased fivefold in a subsequent pregnancy, 95% of women who had sustained previous sphincter injury did not sustain a recurrence.

4.7.2 What Is the Risk of Anal Incontinence after Another Vaginal Delivery?

Poen et al.²⁹ identified 43 women (out of original cohort of 117) who had subsequent vaginal deliveries following previous OASIS. The rate of anal incontinence was 56% compared to 34% in those who did not subsequently deliver (relative risk 1.6; 95% confidence interval 1.1–2.5). There was no comparable CS group.

Sangalli et al.¹⁴ studied 177 women some 13 years after OASIS (48 fourth degree tears). Anal incontinence was significantly more common in women who had sustained fourth degree tears compared with those with third degree tears (25 vs 11.5%; $P = 0.049$). Unlike women with previous fourth degree tears, those who had sustained a previous third degree tear did not demonstrate an increase in anal incontinence symptoms after a subsequent vaginal delivery. This is in keeping with the findings of Fenner et al.,²⁵ who found that the symptom of worse bowel control was 10 times higher in women who sustained fourth as opposed to third degree tears. This could be attributed to persistent injury of the IAS.

Overall, the answer to this question remains inconclusive as the data available are retrospective and very limited.

4.7.3 What Is Recommended Practice?

If there are no facilities for anal manometry and endosonography (Figure 4.11), the management of a subsequent pregnancy will depend on symptomatic and clinical evaluation. Asymptomatic women without any clinical evidence of sphincter compromise ascertained by assessment of anal tone could be allowed to have a vaginal delivery. All women who are symptomatic should be referred to a centre with facilities for anorectal assessment and should be counselled for CS.

4.7.3.1 Asymptomatic Women

Asymptomatic women who have minimal compromise of their anal sphincter function (satisfactory pressure measurements and ultrasound images) should be allowed to have a vaginal delivery. These women should be counselled that they

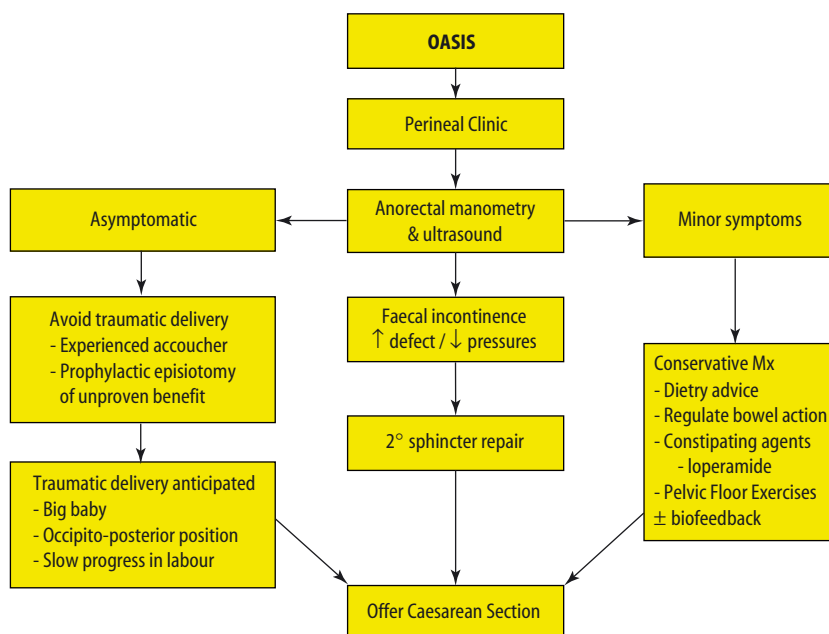


FIGURE 4.11. Flow diagram demonstrating the management of obstetric anal sphincter injuries (OASIS).

have a 95% chance of not sustaining recurrent OASIS⁹ or developing de novo anal incontinence following delivery.⁶⁸ However, the delivery should be conducted by an experienced doctor or midwife. If an episiotomy is considered necessary, e.g. because of a thick inelastic or scarred perineum, a mediolateral episiotomy should be performed. There is no evidence that routine episiotomies prevent recurrence of OASIS. The threshold at which these women may be considered for a CS may be lowered if a traumatic delivery is anticipated, e.g. in the presence of one or more additional relative risk factors such as a big baby, shoulder dystocia, prolonged labour, difficult instrumental delivery. However, in deciding the mode of delivery, counselling (and its clear documentation) is extremely important. Some of these women who have sustained OASIS may be scarred both physically and emotionally and may find it difficult to cope with the thought of another vaginal delivery. These women will require sympathy, psychological support and consideration to their request for CS.

4.7.3.2 Symptomatic Women

All symptomatic women are first treated conservatively (see Chapter 11) depending on their main symptoms and findings at investigation.

Women who suffer from varying degrees of irritable bowel syndrome will need evaluation and appropriate dietary advice depending on whether their bowel pattern is diarrhoea or constipation predominant. It has been shown that in women who have pre-existing irritable bowel syndrome, symptoms of defaecatory urgency and/or flatus incontinence deteriorate significantly following vaginal delivery independent of anal sphincter injury.⁶⁹

Conservative management of anal incontinence is described in detail in Chapter 11 and is summarised as follows:

- All women are included in the biofeedback programme (Chapter 11).
- If muscle contractility is weak or absent, electrical muscle stimulation is commenced.
- Women with flatus incontinence are given dietary advice, especially the avoidance of gas-producing foods such as legumes.
- Women with faecal incontinence are commenced on a low residue diet and constipating agents such as loperamide can be used.

Women whose symptoms are adequately controlled by conservative measures are offered CS in any subsequent delivery so as to minimise the risk of further compromise to anal sphincter function.

Women with faecal incontinence in whom conservative measures have failed should be offered anal sphincter surgery (Chapter 12A), while others may need advanced surgical techniques as described in Chapter 12B. All women who have undergone successful incontinence surgery should be delivered by CS.

A management dilemma arises in women who suffer from faecal incontinence but who wish further pregnancies. These women could avoid a CS and undergo a vaginal delivery followed by a secondary sphincter repair at a later date. The only rationale behind this is that most of the damage that occurs during childbirth occurs with the first vaginal delivery^{68,70} and therefore the risk of further damage during a subsequent vaginal delivery is relatively small. However, there is a potentially unquantified risk of deteriorating pudendal neuropathy. By contrast, CS is not without major morbidity and mortality.⁷¹ Therefore counselling plays an important role in the decision-making process.

4.7.4 How Safe Is Caesarean Section?

The greatest fear of women who have sustained OASIS is a recurrence of the injury and associated risk of faecal incontinence. Clearly CS alleviates these fears but it has a greater impact on morbidity and mortality (see Chapter 5). In particular, CS is associated with an increased risk of maternal mortality, peripartum hysterectomy, urinary tract injury, thromboembolic disease, etc.⁷² Furthermore, there are implications for future pregnancies, as there is an increased risk of placenta praevia, uterine rupture, antepartum stillbirth and infertility.⁷² In an analytical model looking at elective CS for women with previous OASIS,⁷³ McKenna reported that a woman who chooses a CS has an 11.3% risk of morbidity compared to 4.2% following vaginal delivery (relative risk 2.7) and the relative risk of maternal death was 2.6 following CS. It is therefore important that women who request CS on demand are made fully aware of the associated risks. In the UK, an obstetrician can refuse to perform a CS on request without a medical indication, although the woman has the right to seek a second opinion. In the USA, an obstetrician can also refuse to perform a CS on

request. However, the woman has the right to seek a second opinion and to change doctors. In many cases, the third-party payer will not pay for a CS on request without a medical indication.

4.7.5 Can Objective Assessments Predict Who Will Develop Incontinence?

There are limited prospective studies to address this issue. Fynes et al.⁶⁸ performed a prospective study of 59 women at three time points: 34 weeks gestation of their first pregnancy and 6–12 weeks after two consecutive vaginal deliveries. They found that out of all the asymptomatic women after the first vaginal delivery who were found to have a large “occult” sonographic anal sphincter defect (>one quadrant) or anal squeeze pressures of less than 20 mmHg, 75% (six of eight) became symptomatic after the second vaginal delivery. By contrast, only 5% (two of the 43) with less extensive defects became symptomatic ($P < 0.0001$). There is an increasing awareness of the role of the IAS in maintaining continence. Nichols et al.²² followed up 56 women who sustained OASIS and found that combined defects of the IAS and EAS were associated with the highest risk of bowel symptoms compared to an intact sphincter (odds ratio 18.7; CI 3–101, $P < 0.001$) and isolated defects of the EAS (odds ratio 15.7; 95% CI 3–76; $P = 0.003$).

4.8 Who Should Be Performing Acute Primary Obstetric Sphincter Repairs?

In view of the observed suboptimal outcome associated with primary anal sphincter repair when performed by obstetricians with varying degrees of experience (Table 4.1), it has been suggested that perhaps a repair performed by colorectal surgeons may be associated with a better outcome.^{16,74,75} However, in a study (described above)⁵³ the outcome was no better. Furthermore, in a survey of colorectal practice in the UK,⁶⁰ only 6.7% of colorectal surgeons reported that they performed more than ten acute repairs per year, 60% had never performed an acute sphincter repair and 30% performed fewer than five per year. It is

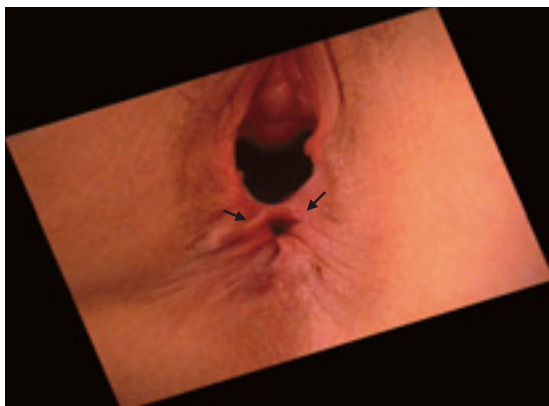


FIGURE 4.12. Demonstration of a cloacal defect following a missed third degree tear. The perineal body is absent and the external sphincter is deficient between 10 and 2 o'clock (between arrows) as noted by the absence of the corrugator cutis ani.

therefore not surprising that only 19% of colorectal surgeons believed that they should be involved in the acute management of OASIS. We believe that the most experienced clinician should perform the repair as soon as possible after the injury. Ideally, the most appropriate trained clinician should be an obstetrician who would be easily accessible at any time. It has been suggested that perhaps it may be prudent to leave women with OASIS overnight, particularly those who have delivered at night, until a colorectal surgeon becomes available to perform the repair.⁷⁶ We believe that it would be unkind to leave a woman who had just delivered until the morning. She may be actively bleeding, the tissues may become oedematous and there is an added risk of infection. This delay would create unnecessary anxiety at a time when the parents should be celebrating the birth of their child. However, a delay in repair may be justified in exceptional circumstances when an experienced obstetrician may not be available. Furthermore, women who sustain OASIS often have concomitant vaginal lacerations (some multiple and deep) that will need to be repaired by an obstetrician (as well as reconstruction of the perineal body). It was concerning to note that 30% of colorectal surgeons recommended a covering colostomy for OASIS, confirming that while they may have expertise in dealing with women presenting with faecal incontinence (Figure 4.12),

(see Chapters 12a and 12b) very few have any experience with acute OASIS.⁶⁰

4.9 Education and Training

Deficiencies in training programmes of doctors and midwives have already been alluded to in Chapters 2 and 3. Doctors and midwives have indicated that their training in perineal anatomy and ability to recognise OASIS are suboptimal.⁷⁷ There are also inconsistencies in classification of perineal trauma, as one third of doctors were classifying third degree tears as second degree (see Chapter 2). Most trainee doctors admitted that their training in recognising (84%) and repairing (94%) OASIS was poor⁷⁷ and 64% of consultants reported unsatisfactory or no training in the management of OASIS.⁶⁰

In view of this, we initiated an international hands-on workshop on the management of OASIS in February 2000 (www.perineum.net). The OASIS workshop is structured to include lectures and demonstrations of anatomy and repair using a specifically designed latex anal sphincter model (Figure 4.13), video demonstrations and pig anal sphincters (Figure 4.14). By February 2006, we had conducted 30 such hands-on workshops in the UK and in order to establish the usefulness of such a course we conducted an audit of the first 80 delegates. The delegates completed a questionnaire before and 3 months after attending the workshop. Only 33% admitted to any prior formal



FIGURE 4.13. The Sultan anal sphincter trainer with a central replaceable block has been designed for hands-on teaching (www.perineum.net).

training in repair of OASIS. At 3 months, 78% admitted to a change in clinical practice in terms of repairing the IAS, 29% introduced a protocol for repair of OASIS and 34% changed their management of subsequent pregnancies.⁷⁸ The feedback from attendees was that this programme should become an essential part of the modular training for career trainees. A number of similar courses have now been established nationally and internationally.

Since October 2002, we have introduced a second international hands-on workshop specifically for midwives and trainee doctors, in which we teach anatomy and emphasise the need for rectal examinations to ensure that OASIS do not remain undiagnosed.⁷⁹ The delegates are also taught repair of episiotomy and spontaneous first and secondary tears. A prospective audit of knowledge and practice was conducted by completion of a questionnaire before and 2 months after the course ($n = 147$). This revealed a significant improvement in accurate classification of perineal trauma as well as in repair technique. All doctors and most midwives changed their practice in that they routinely performed a rectal examination to evaluate the full extent of perineal trauma (and to exclude OASIS) prior to suturing.⁸⁰

Concern about training has also been raised by McLennan et al.,⁸¹ who surveyed 1,177 fourth-year residents and had a 25% response rate. They found that the majority of residents had received no formal training in pelvic floor anatomy, epis-



FIGURE 4.15. Political interaction between the obstetrician (MRCOG) and the surgeon (FRCS) regarding the “bottom line”.

otomy or perineal repair, and supervision during perineal repair was limited. Similar to the findings of our survey of popular textbooks in the UK,⁵⁶ Stepp et al.⁸² found that textbooks used in American practice offered little in terms of prevention and repair of perineal trauma. Strategies for prevention of OASIS are discussed in Chapter 5. One explanation for the inadequate training in anatomy and pathophysiology can be attributed to the compartmentalisation of the pelvic floor such that many specialities (obstetricians, colorectal surgeons, urologists, gastroenterologists, etc.) deal with conditions that are in close proximity to each other. The territorial effects have been well illustrated by Wall and DeLancey⁸³ in an excellent article on the “politics of the pelvic floor”. Unfortunately, the “bottom line” is that politics also exist on the perineum, where an arbitrary dividing line has been drawn separating the territory of the obstetrician from that of the surgeon (Figure 4.15). The problem to hand is that no one can identify the exact location of this line. Consequently there is a large grey zone on either side of this line that each speciality believes belongs to the other . . . leaving a chasm in education and training that this book endeavours to fill.

4.10 Conclusion

Obstetric anal sphincter injuries occur in about 20% of women undergoing their first vaginal delivery (in centres that practise midline episiotomy).

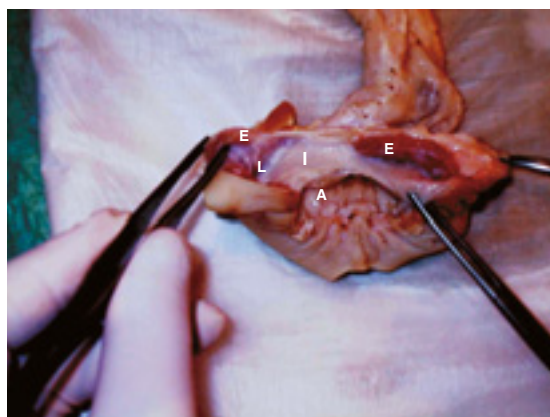


FIGURE 4.14. The pig anal sphincter demonstrating the external sphincter (E), longitudinal muscle coat (L), internal sphincter (I) and anal epithelium (A).

Overall, although there has been a notable increase in the prevalence of OASIS, it could be largely attributed to improvements in detection of such injuries. When such injuries are identified, it is imperative that they are repaired by a skilled clinician under optimal conditions. A good understanding of perineal and anal sphincter anatomy and adherence to sound principles (described above) are essential. Although the technique of overlap repair of the external sphincter may be associated with a better outcome, it remains to be established whether this could be achieved universally. Until then, depending on the expertise of the operator, either the overlap or end-to-end repair technique can be used for repair. There is an obvious demand for focused education and training in perineal anatomy, recognition of OASIS and training in repair techniques. Hands-on workshops with video recordings, models and pig anal sphincters are now very popular and have proved to be very successful.

References

- Magdi I. Obstetric injuries of the perineum. *J Obstet Gynaecol Br Commonw* 1949;49:687–700.
- Garrigues HJ. The obstetric treatment of the perineum. *Am J Obstet Gynecol* 1880;13(2): 231–64.
- Royston GD. Repair of complete perineal laceration. *Am J Obstet Gynecol* 1930;19:185–95.
- Kaltreider DF. A study of 710 complete lacerations following central episiotomy. *South Med J* 1948;41: 814–20.
- Ingraham HA. A report on 159 third degree tears. *Am J Obstet Gynecol* 1949;57:730–5.
- Fulsher RW, Fearl CL. The third-degree laceration in modern obstetrics. *Am J Obstet Gynecol* 1955; 69:786–93.
- Cunningham CB, Pilkington JW. Complete perineotomy. *Am J Obstet Gynecol* 1955;70:1225–31.
- Sultan AH, Monga AK, Kumar D, Stanton SL. Primary repair of obstetric anal sphincter rupture using the overlap technique. *Br J Obstet Gynaecol* 1999;106:318–23.
- Harkin R, Fitzpatrick M, O'Connell PR, O'Herlihy C. Anal sphincter disruption at vaginal delivery: is recurrence predictable? *Eur J Obstet Gynecol Reprod Biol* 2003;109(2):149–52.
- Coats PM, Chan KK, Wilkins M, Beard RJ. A comparison between midline and mediolateral episiotomies. *Br J Obstet Gynaecol* 1980;87:408–12.
- Peleg D, Kennedy CM, Merrill D, Zlatnik FJ. Risk of repetition of a severe perineal laceration. *Obstet Gynecol* 1999;93(6):1021–4.
- Norderval S, Nsubuga D, Bjelke C, Frasurek J, Myklebust I, Vonen B. Anal incontinence after obstetric sphincter tears: incidence in a Norwegian county. *Acta Obstet Gynecol Scand* 2004;83(10): 989–94.
- Fitzpatrick M, Behan M, O'Connell R, O'Herlihy C. A randomized clinical trial comparing primary overlap with approximation repair of third-degree obstetric tears. *Am J Obstet Gynecol* 2000;183: 1220–4.
- Sangalli MR, Floris L, Faltin D, Weil A. Anal incontinence in women with third or fourth degree perineal tears and subsequent vaginal deliveries. *Aust N Z J Obstet Gynaecol* 2000;40(3):244–8.
- Wood J, Amos L, Rieger N. Third degree anal sphincter tears: risk factors and outcome. *Aust N Z J Obstet Gynaecol* 1998;38(4):414–17.
- Walsh CJ, Mooney EF, Upton GJ, Motson RW. Incidence of third-degree perineal tears in labour and outcome after primary repair. *Br J Surg* 1996;83(2): 218–21.
- Sander P, Bjarnesen J, Mouritsen L, Fuglsang-Frederiksen A. Anal incontinence after obstetric third-/fourth-degree laceration. One-year follow-up after pelvic floor exercises. *Int Urogynecol J Pelvic Floor Dysfunct* 1999;10(3):177–81.
- Pretlove SJ, Thompson PJ, Guest P, Toozs-Hobson P, Radley S. Detecting anal sphincter injury: acceptability and feasibility of endoanal ultrasound immediately postpartum. *Ultrasound Obstet Gynecol* 2003;22(2):215–17.
- Crawford LA, Quint EH, Pearl ML, DeLancey JO. Incontinence following rupture of the anal sphincter during delivery. *Obstet Gynecol* 1993;82(4 Pt 1):527–31.
- Sorensen M, Tetzschner T, Rasmussen OO, Bjarneesen J, Christiansen J. Sphincter rupture in childbirth. *Br J Surg* 1993;80(3):392–4.
- Mackenzie N, Parry L, Tasker M, Gowland MR, Michie HR, Hobbiss JH. Anal function following third degree tears. *Colorectal Dis* 2004;6(2):92–6.
- Nichols CM, Lamb EH, Ramakrishnan V. Differences in outcomes after third- versus fourth-degree perineal laceration repair: a prospective study. *Am J Obstet Gynecol* 2005;193(2):530–4.
- Nielsen MB, Hauge C, Rasmussen OO, Pedersen JF, Christiansen J. Anal endosonographic findings in the follow-up of primarily sutured sphincteric ruptures. *Br J Surg* 1992;79(2):104–6.
- Go PM, Dunselman GA. Anatomic and functional results of surgical repair after total perineal rupture

- at delivery. *Surg Gynecol Obstet* 1988;166(2): 121–4.
25. Fenner DE, Genberg B, Brahma P, Marek L, DeLancey JOL. Fecal and urinary incontinence after vaginal delivery with anal sphincter disruption in an obstetrics unit in the United States. *Am J Obstet Gynecol* 2003;189:1543–50.
26. De Leeuw JW, Vierhout ME, Struijk PC, Hop WC, Wallenburg HC. Anal sphincter damage after vaginal delivery: functional outcome and risk factors for fecal incontinence. *Acta Obstet Gynecol Scand* 2001;80:830–4.
27. Wagenius J, Laurin J. Clinical symptoms after anal sphincter rupture: a retrospective study. *Acta Obstet Gynecol Scand* 2003;82(3):246–50.
28. Fornell EK, Berg G, Hallbook O, Matthiesen LS, Sjodahl R. Clinical consequences of anal sphincter rupture during vaginal delivery. *J Am Coll Surg* 1996;183(6):553–8.
29. Poen AC, Felt-Bersma RJ, Strijers RL, Dekker GA, Cuesta MA, Meuwissen SG. Third-degree obstetric perineal tear: long-term clinical and functional results after primary repair. *Br J Surg* 1998;85(10): 1433–8.
30. Sultan AH, Kamm MA, Hudson CN, Bartram CI. Third degree obstetric anal sphincter tears: risk factors and outcome of primary repair. *Br Med J* 1994;308:887–91.
31. Zetterstrom J, Lopez A, Anzen B, Norman M, Holmstrom B, Mellgren A. Anal sphincter tears at vaginal delivery: risk factors and clinical outcome of primary repair. *Obstet Gynecol* 1999;94(1): 21–8.
32. Mellerup Sorensen S, Bondesen H, Istre O, Vilmann P. Perineal rupture following vaginal delivery. Long-term consequences. *Acta Obstet Gynecol Scand* 1988;67(4):315–18.
33. Tetzschner T, Sorensen M, Lose G, Christiansen J. Anal and urinary incontinence in women with obstetric anal sphincter rupture. *Br J Obstet Gynaecol* 1996;103(10):1034–40.
34. Williams A, Adams EJ, Bolderson J, Tincello DG, Richmond DH. Effect of a new guideline on outcome following third-degree perineal tears: results of a 3-year audit. *Int Urogynecol J Pelvic Floor Dysfunct* 2003;14(6):385–9.
35. Garcia V, Rogers RG, Kim SS, Hall RJ, Kammerer-Doak DN. Primary repair of obstetric anal sphincter laceration: a randomized trial of two surgical techniques. *Am J Obstet Gynecol* 2005;192(5): 1697–701.
36. Kammerer-Doak DN, Wesol AB, Rogers RG, Dominguez CE, Dorin MH. A prospective cohort study of women after primary repair of obstetric anal sphincter laceration. *Am J Obstet Gynecol* 1999;181(6):1317–22.
37. Haadem K, Ohrlander S, Lingman G. Long-term ailments due to anal sphincter rupture caused by delivery—a hidden problem. *Eur J Obstet Gynecol Reprod Biol* 1988;27(1):27–32.
38. Rieger N, Perera S, Stephens J, Coates D, Po D. Anal sphincter function and integrity after primary repair of third-degree tear: uncontrolled prospective analysis. *ANZ J Surg* 2004;74(3): 122–4.
39. Bek KM, Laurberg S. Risks of anal incontinence from subsequent vaginal delivery after a complete obstetric anal sphincter tear. *Br J Obstet Gynaecol* 1992;99(9):724–6.
40. Davis K, Kumar D, Stanton SL, Thakar R, Fynes M, Bland J. Symptoms and anal sphincter morphology following primary repair of third-degree tears. *Br J Surg* 2003;90(12):1573–9.
41. Nazir M, Carlsen E, Jacobsen AF, Nesheim BI. Is there any correlation between objective anal testing, rupture grade, and bowel symptoms after primary repair of obstetric anal sphincter rupture?: an observational cohort study. *Dis Colon Rectum* 2002;45(10):1325–31.
42. Gjessing H, Backe B, Sahlin Y. Third degree obstetric tears; outcome after primary repair. *Acta Obstet Gynecol Scand* 1998;77(7):736–40.
43. Savoye-Collet C, Savoye G, Koning E, Sassi A, Leroi AM, Dacher JN. Endosonography in the evaluation of anal function after primary repair of a third-degree obstetric tear. *Scand J Gastroenterol* 2003; 38(11):1149–53.
44. Goffeng AR, Andersch B, Andersson M, Berndtsson I, Hulten L, Oresland T. Objective methods cannot predict anal incontinence after primary repair of extensive anal tears. *Acta Obstet Gynecol Scand* 1998;77(4):439–43.
45. Nygaard IE, Rao SS, Dawson JD. Anal incontinence after anal sphincter disruption: a 30-year retrospective cohort study. *Obstet Gynecol* 1997;89(6): 896–901.
46. Pinta TM, Kylanpaa ML, Salmi TK, Teramo KA, Luukkonen PS. Primary sphincter repair: are the results of the operation good enough? *Dis Colon Rectum* 2004;47(1):18–23.
47. Abramowitz L, Sobhani I, Ganansia R, Vuagnat A, Benifla JL, Darai E, et al. Are sphincter defects the cause of anal incontinence after vaginal delivery? Results of a prospective study. *Dis Colon Rectum* 2000;43(5):590–6.
48. Parks AG, McPartlin JF. Late repair of injuries of the anal sphincter. *Proc R Soc Med* 1971;64(12): 1187–9.

49. Jorge JM, Wexner SD. Etiology and management of fecal incontinence. *Dis Colon Rectum* 1993;36(1): 77–97.
50. Engel AF, Kamm MA, Sultan AH, Bartram CI, Nicholls RJ. Anterior anal sphincter repair in patients with obstetric trauma. *Br J Surg* 1994;81(8): 1231–4.
51. Malouf AJ, Norton CS, Engel AF, Nicholls RJ, Kamm MA. Long-term results of overlapping anterior anal-sphincter repair for obstetric trauma. *Lancet* 2000;355(9200):260–5.
52. Sultan AH. Third degree tear repair. In: MacClean AB, Cardozo L, eds. *Incontinence in women*. London: RCOG Press, 2002, pp 379–90.
53. Kairaluoma MV, Raivio P, Aarnio MT, Kellokumpu IH. Immediate repair of obstetric anal sphincter rupture: medium-term outcome of the overlap technique. *Dis Colon Rectum* 2004;47(8):1358–63.
54. Williams A, Adams EJ, Tincello DG, Alfirevic Z, Walkinshaw SA, Richmond DH. How to repair an anal sphincter injury after vaginal delivery: results of a randomised controlled trial. *BJOG* 2006;113(2): 201–7.
55. Fernando R, Sultan AH, Kettle C, Radley S, Jones P, O'Brien S. Repair techniques for obstetric anal sphincter injuries: a randomized trial. *Obstet Gynecol* 2006;107:1261–8.
56. Sultan AH, Thakar R. Lower genital tract and anal sphincter trauma. *Best Pract & Res – Clin Obstet Gynaecol* 2002;16:99–116.
57. Katz S, Izhar M, Mirelman D. Bacterial adherence to surgical sutures. A possible factor in sutures induced infection. *Annals Surg* 1981;194(1):35–41.
58. Meyenberger C, Bertschinger P, Zala GF, Buchmann P. Anal sphincter defects in fecal incontinence: correlation between endosonography and surgery. *Endoscopy* 1996;28(2):217–24.
59. Hool GR, Lieber ML, Church JM. Postoperative anal canal length predicts outcome in patients having sphincter repair for fecal incontinence. *Dis Colon Rectum* 1999;42(3):313–18.
60. Fernando RJ, Sultan AH, Radley S, Jones PW, Johanson RB. Management of obstetric anal sphincter injury: a systematic review and national practice survey. *BMC Health Serv Res* 2002;2(1):9.
61. MacArthur AJ, MacArthur C. Incidence, severity, and determinants of perineal pain after vaginal delivery: a prospective cohort study. *Am J Obstet Gynecol* 2004;191(4):1199–204.
62. Hedayati H, Parsons J, Crowther CA. Rectal analgesia for pain from perineal trauma following childbirth. *Cochrane Database Syst Rev* 2003(3): CD003931.
63. Kettle C, Hills RK, Jones P, Darby L, Gray R, Johanson R. Continuous versus interrupted perineal repair with standard or rapidly absorbed sutures after spontaneous vaginal birth: a randomised controlled trial. *Lancet* 2002;359(9325):2217–23.
64. Mahony R, Behan M, O'Herlihy C, O'Connell PR. Randomized, clinical trial of bowel confinement vs. laxative use after primary repair of a third-degree obstetric anal sphincter tear. *Dis Colon Rectum* 2004;47(1):12–17.
65. Nessim A, Wexner SD, Agachan F, Alabaz O, Weiss EG, Noguera JJ, et al. Is bowel confinement necessary after anorectal reconstructive surgery? A prospective, randomized, surgeon-blinded trial. *Dis Colon Rectum* 1999;42(1):16–23.
66. Williams A, Lavender T, Richmond DH, Tincello DG. Women's experiences after a third-degree obstetric anal sphincter tear: a qualitative study. *Birth* 2005;32(2):129–36.
67. Payne TN, Carey JC, Rayburn WF. Prior third- or fourth-degree perineal tears and recurrence risks. *Int J Gynecol Obstet* 1999;64:55–7.
68. Fynes M, Donnelly V, Behan M, O'Connell PR, O'Herlihy C. Effect of second vaginal delivery on anorectal physiology and faecal continence: a prospective study [see comments]. *Lancet* 1999; 354(9183):983–6.
69. Donnelly V, Fynes M, Campbell D, Johnson H, O'Connell PR, O'Herlihy C. Obstetric events leading to anal sphincter damage. *Obstet Gynecol* 1998; 92(6):955–61.
70. Sultan AH, Kamm MA, Hudson CN, Thomas JM, Bartram CI. Anal sphincter disruption during vaginal delivery. *New Engl J Med* 1993;329: 1905–11.
71. Sultan AH, Stanton SL. Preserving the pelvic floor and perineum during childbirth – elective caesarean section? *Br J Obstet Gynaecol* 1996;103(8): 731–4.
72. National Institute for Health and Clinical Excellence. *Caesarean section: clinical guideline*. London: NICE, 2004.
73. McKenna DS, Ester JB, Fischer JR. Elective cesarean delivery for women with a previous anal sphincter rupture. *Am J Obstet Gynecol* 2003;189(5):1251–6.
74. Sultan AH, Kamm MA. Faecal incontinence after childbirth. *Br J Obstet Gynaecol* 1997;104(9): 979–82.
75. Cook TA, Mortensen NJ. Management of faecal incontinence following obstetric injury. *Br J Surg* 1998;85(3):293–9.
76. Sultan AH. Third degree tear repair. In: MacClean AB, Cardozo L, eds. *Incontinence in women*. London: RCOG Press, 2002, pp 420–30.

77. Sultan AH, Kamm MA, Hudson CN. Obstetric perineal tears: an audit of training. *J Obstet Gynaecol* 1995;15:19–23.
78. Thakar R, Sultan AH, Fernando R, Monga A, Stanton S. Can workshops on obstetric anal sphincter rupture change practice? *Int Urogynecol J* 2001; 12:S5.
79. Andrews V, Thakar R, Sultan AH, Kettle C. Can hands-on perineal repair courses affect clinical practice? *Br J Midwifery* 2005;13(9).
80. Andrews V, Sultan AH, Thakar R, Jones PW. Occult anal sphincter injuries—myth or reality? *BJOG* 2006; 113(2):195–200.
81. McLennan MT, Melick CF, Clancy SL, Artal R. Episiotomy and perineal repair. An evaluation of resident education and experience. *J Reprod Med* 2002;47(12):1025–30.
82. Stepp KJ, Siddiqui NY, Emery SP, Barber MD. Text-book recommendations for preventing and treating perineal injury at vaginal delivery. *Obstet Gynecol* 2006;107(2):361–6.
83. Wall LL, DeLancey JO. The politics of prolapse: a revisionist approach to disorders of the pelvic floor in women. *Perspect Biol Med* 1991;34(4): 486–96.

Perineal and Anal Sphincter Trauma

Diagnosis and Clinical Management

Sultan, A.H.; Thakar, R.; Fenner, D.E. (Eds.)

2007, XII, 196 p. 82 illus., 32 illus. in color., Hardcover

ISBN: 978-1-85233-926-5