OXFORD

BJS, 2021, 1–14
DOI: 10.1093/bjs/znab128
Guideline

European Hernia Society guidelines on management of rectus diastasis

P. Hernández-Granados [1,*], N. A. Henriksen [2], F. Berrevoet [3], D. Cucurullo[4], M. López-Cano [5], S. Nienhuijs[6], D. Ross[7] and A. Montgomery[8]

[1]General Surgery Unit, Fundación Alcorcón University Hospital, Alcorcón, Spain
[2]Department of Surgery, Gastro Unit, Herlev Hospital, Zealand University Hospital and University of Copenhagen, Copenhagen, Denmark
[3]General and Hepatopancreatobiliary Surgery and Liver transplantation, Ghent University Hospital, Ghent, Belgium
[4]Department of General, Laparoscopic and Robotic Surgery, AORN dei Colli, Monaldi Hospital, Naples, Italy
[5]Abdominal Wall Surgery Unit, Val d'Hebrón University Hospital, Universidad Autónoma de Barcelona, Barcelona, Spain
[6]Surgery, Catharina Hospital, Eindhoven, the Netherlands
[7]Department of Plastic Surgery, The London Clinic and St Thomas' Hospital, London, UK
[8]Surgical Department, Skåne University Hospital Malmö, Lund University, Sweden

Correspondence to: P. Hernández-Granados, C/ Moreras, 68. 4° B. 28221 Majadahonda, Spain (e-mail: pilar.mphernandez@gmail.com)

Abstract

Background: The definition, classification, and management of rectus diastasis (RD) are controversial in the literature, and a variety of different surgical treatments have been described. This article reports on the European Hernia Society (EHS) Clinical Practice Guideline for RD.

Method: The Guideline Group consisted of eight surgeons. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach and the Appraisal of Guidelines for Research and Evaluation (AGREE) instrument were used. A systematic literature search was done in November 2018, and updated in November 2019 and October 2020. Nine key questions (KQs) were formulated.

Results: Literature reporting on the definition, classification, symptoms, outcomes, and treatments was limited in quality, leading to weak recommendations for the majority of the KQs. The main recommendation is to define RD as a separation between rectus muscles wider than 2 cm. A new classification system is suggested based on the width of muscle separation, postpregnancy status, and whether or not there is a concomitant hernia. Impaired body image and core instability appear to be the most relevant symptoms. Physiotherapy may be considered before surgical management. It is suggested to use linea alba plication in patients without concomitant hernia and a mesh-based repair of RD in those with concomitant midline hernias.

Conclusion: RD should be defined as a separation of rectus muscles wider than 2 cm and a new classification system is suggested.

Lay summary

The management of RD is controversial. These guidelines are intended to provide a consensus about the exact definition, the correct way of measurement and diagnosis, a classification system, the main symptoms, and a systematic review of non-surgical and surgical treatments to achieve the best results for patients with this pathology. The main recommendation is to define RD as a separation between rectus muscles wider than 2 cm. A new classification system is proposed. It is suggested to use linea alba plication in patients without concomitant hernia and a mesh-based repair of RD in those with concomitant midline hernias.

Introduction

In recent years, the European Hernia Society (EHS) has developed different Clinical Practice Guidelines (CPGs), alone[1–4], or in collaboration with other societies[5,6]. These guidelines are intended to help physicians and patients make informed healthcare choices and to aid policymakers in making policy-related decisions[7]. The management of patients with rectus diastasis (RD) is the focus of the present guideline.

RD describes the separation of the rectus abdominis muscles, and is characterized by thinning and widening of the linea alba[8]. This causes the midline to bulge when intra-abdominal pressure is increased. RD is not a hernia because it does not have a true fascial defect. It is a condition mostly seen in women after pregnancy and, to a lesser extent, in obese men[9].

In many countries, there is no financial cover for the surgical repair of RD presented as a solitary condition; correction is mostly undertaken during abdominoplasty by plastic surgeons in private practice. Now, the development of minimally invasive techniques for treating RD has led to an increase in referrals to dedicated hernia surgeons and consideration of the role that these novel

Received: January 01, 2021. **Accepted:** March 21, 2021

techniques may play. There is a lack of consensus in the literature on the definition, diagnosis, and therapeutic management of RD.

Consequently, the EHS embarked on a systematic and comprehensive review of the evidence in order to provide a CPG, and generate statements that include recommendations intended to optimize the management of RD, and evaluate the potential application of alternative care options.

Methods

The project was approved during the EHS board meeting in March 2018. P.H.-G. and A.M. were assigned to coordinate the project. A further six surgeons across Europe were included in the group approved by the EHS Board, comprising five general surgeons representing Belgium, Denmark, Italy, the Netherlands, and Spain, and one plastic surgeon from the UK. The guideline is intended to assist surgeons, general practitioners and patients. Conflicts of interest of each member were recorded transparently.

The guideline protocol development was designed by the coordinators between May and June 2018. A preliminary literature search was performed by one of the coordinators and a clinical librarian. The first meeting of the team was held in Madrid on 13 and 14 December 2018. Nine key questions (KQs) were formulated, discussed, and approved by consensus of the team. The first bibliographic search was performed by one of the coordinators and a clinical librarian. PUBMED, Embase, and Physiotherapy Evidence database (PEDro) were searched with no date or language limits. The search strategy is available in *Appendix S1*.

The KQs were formulated and translated into Patient–Intervention–Comparison–Outcome (PICO) formats. Each KQ was assigned to two members of the group. An update of the literature search was carried out on 25 November 2019, adding a search into the Cumulative Index to Nursing and Allied Health Literature (CINAHL), performed by one of the members of the group. Selected designs were RCTs and non-randomized studies (observational studies: cross-sectional, case–control studies, cohort studies, and case series). Case reports, case series including fewer than five patients, and expert opinion were excluded. All papers considered relevant to each KQ were obtained in full-text format. A second meeting of the team was held in Copenhagen on 28 and 29 November 2019. The meetings were funded by the EHS, with no involvement of industry. A last literature search update was undertaken on 1 October 2020.

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) system was used to guide methodology and structure during production of the guidelines[10]. In the absence of patient participation, the guidelines team used their previous experiences with the target population to assume the relevant values and preferences. Moreover, the Guidelines Group based the choice of outcomes on what is important in the management of RD and the outcome criteria were scored according to GRADE recommendation as critical, important but not critical, and of limited importance, and did not influence the search strategy.

Relevant articles were entered into the quality assessment and grading of evidence process[11]. Studies including data considered relevant to each KQ were outlined in a summary-of-findings table. These articles were assessed for their quality by the two members in charge of each KQ using GRADE methodology. Factors influencing the quality of evidence across the studies for different outcomes according to the GRADE approach include study design, risk of bias, inconsistency across the studies (unexplained heterogeneity of results), indirectness of results (direct results consist of research that directly compares the interventions of interest), imprecision (when studies include relatively few patients and few events), publication bias (systematic underestimation or overestimation of beneficial or harmful effect owing to the selective publication of studies), and effect size.

The quality of evidence was rated as: high—very confident that the true effect lies close to that of the estimate of the effect; moderate—moderately confident in the effect estimate, that is, the true effect is likely to be close to the estimate of the effect, but there is a possibility that is substantially different; low—confidence in the effect estimate is limited, that is, the true effect may be substantially different from the estimate of the effect; or very low—very little confidence in the effect estimate, that is, the true effect is likely to be substantially different from the estimate of the effect[11].

Based on the previous assessments, both members in charge of each KQ proposed a statement and recommendation. In line with GRADE methodology[12,13], recommendations were classified as strong or weak.

A strong recommendation indicates that the recommended course of action would be chosen for treating all or almost all patients, and indicates to clinicians that the recommendation is appropriate for all or almost all individuals. Strong recommendations represent candidates for quality-of-care criteria or performance indicators.

A weak recommendation indicates that, for the majority of patients, the suggested course of action would be chosen, but for an appreciable minority it would not. With weak recommendations, clinicians should recognize that different choices will be appropriate for individual patients. Weak recommendations should not be used as a basis for standards of practice, other than to aid in shared decision-making.

A recommendation could be upgraded by consensus by the Guideline Group for important issues, even if the level of evidence was low.

No recommendation was made to answer a KQ if the evidence was absent or inadequate. These guidelines also proffer good practice statements and clinical expertise guidance, which are different from recommendations formally categorized using GRADE. Good practice statements represent common sense practice, are supported by indirect evidence, and are associated with assumed large net benefit. Clinical expertise guidance provides direction in areas for which there is either no published evidence or insufficient evidence to justify a formal recommendation. These do not have the force of recommendations that have been categorized using GRADE or good practice statements[14].

Eight teleconferences were arranged between March and October 2020. Each KQ was presented by one of the members, discussed, and reviewed by the rest of the team. The statements and recommendations were modified and refined in October 2020. The guideline manuscript was sent for review and agreement by all in the group. Before submission it was peer reviewed by two external reviewers who assessed its methodological soundness according to the Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument[15].

Results

KQ1 What is the definition of RD?

Statement: There is limited evidence on an exact definition of RD. RD is an abnormal separation of the two rectus abdominis muscles caused by a thinning and widening of the linea alba. A separation of the rectus muscles of 2 cm or less might be considered physiologically normal.
Recommendation: As a good practice statement RD is defined as a widening of the linea alba exceeding 2 cm.
Quality of evidence: Low
Strength of recommendation: Strong (upgraded)

The linea alba (Latin for white line) runs vertically between the rectus muscles, along the anterior abdominal wall, and extends between the xiphoid process superiorly and the pubic symphysis caudally. The umbilicus passes through the linea alba. The linea alba is formed by the median fusion of the anterior and posterior rectus sheaths. It is composed of a dense fibrous collagen network with strong type I collagen, as the main component, and reticular type III collagen fibres facilitating expansion. Histological studies found that both type I and III collagen are significantly reduced in the linea alba of women with RD compared with those without the condition[16,17].

Rectus diastasis in women

Pregnancy is the predominant cause of RD in women. The growing foetus causes mechanical strain on the abdominal wall, and increasing weight gain and displacement of abdominal organs may also play a role[18]. The structure and function of the abdominal muscles also undergo significant change during pregnancy[19]. Stretching of the linea alba is further facilitated by hormonal changes during pregnancy, causing elastic connective tissue changes. As a consequence, one study[20] observed that approximately one-quarter of women (27 per cent) developed a RD during the second trimester, and this proportion had increased to 66 per cent during the third trimester.

Multiparity, maternal age, heavy lifting, higher BMI, and giving birth by caesarean section have also been suggested as risk factors for the development of RD in women[21–23]. However, other studies[23,24] reported no difference in prepregnancy BMI, weight gain, weight of the baby, or abdominal wall circumference between women with and without RD at 6 months postpartum.

Rectus diastasis in men

The evidence describing RD in men is very limited. Suggested risk factors are increasing age, obesity, raised abdominal wall circumference, full-excursion sit-ups, weight training, and abdominal aortic aneurysm[25,26].

Width of linea alba

The width of the linea alba is normally 1–2 cm, but there is no exact definition of a normal physiological distance and the width varies, especially in parous women[9].

In a cohort of 150 nulliparous women, the mean(s.d.) width of the linea alba measured by ultrasound imaging was 7(5) mm at the xiphoid, and 13(7) mm above and 8(6) mm below the umbilicus. It was concluded that the linea alba can be considered normal up to a width of 15 mm at the xiphoid process, 22 mm at 3 cm above the umbilicus and 16 mm at 2 cm below it[27].

The width of the linea alba increases with age. This was demonstrated in an anatomical study[28] where the linea alba was measured and compared in patients above and below 45 years of age. The width of the linea alba in the younger age group was considered as a RD when more than 10 mm above the umbilicus, 27 mm at umbilical level, and 9 mm below the umbilicus. The corresponding values were 15, 27, and 14 mm in people aged over 45 years.

In a third study[29], the width of the linea alba was recorded during and after pregnancy at 3 locations. At week 35 of pregnancy, the inter-rectus distance (IRD) measured between 44 and 79 mm at 5 cm above the umbilicus. At 2 cm above, it was 54–86 mm, and at 2 cm below the umbilicus it was 49–79 mm. At 6 months postpartum, the corresponding IRD was 12–24, 17–28, and 9–21 mm respectively. In primiparous women the linea alba width may still be considered normal up to values wider than in nulliparous women[18].

Based on these studies, it was concluded that a linea alba width up to 2 cm may be considered normal, whereas RD may be defined by a width above 2 cm, irrespective of location. Even though the level of evidence is low, the Guideline Group believes that the strength of recommendation should be strong.

KQ2 Which modalities are most suitable for diagnosis and assessment of RD?

Statement: Clinical examination and measurement using the 'finger width' method appears adequate for diagnosing RD. Measurement of the inter-rectus distance using either ultrasound or calipers is a reliable method. There is limited evidence to support the use of CT.
Recommendation: Clinical examination is suggested for diagnosing RD in most patients. CT may be useful in detecting a concomitant hernia and for surgical planning. For more precise measurement, the use of ultrasound imaging or calipers at 3 cm above the umbilicus is suggested.
Quality of evidence: Low
Strength of recommendation: Weak

The width of the linea alba can vary depending on several factors. These include the method of measurement, the anatomical location, and whether measurements are taken at rest or during active contraction. A systematic review[30] of 13 studies assessed different methods used to measure IRD. Techniques evaluated included use of finger width, tape measure, calipers, ultrasound imaging, CT and MRI, although the quality of studies varied.

Clinical examination, with the rectus muscles at rest and under tension, is probably the most widely used method to assess whether a patient has RD or not. The finger-width measurement is then commonly used to assess the extent of muscle separation. However, the validity of this method has not been examined in the literature. One study[31] evaluated the use of CT for measuring the width of the linea alba, and concluded that it seemed to underestimate the width compared with measurement during subsequent RD repair. There are no further data available supporting the use of CT or MRI for assessing RD.

Ultrasound examination is the most evaluated method for RD assessment. Ultrasonography and use of calipers were regarded

as equally adequate methods for assessment of RD, with low measurement error between methods and agreement for discriminative purposes as the review published by van der Waters established[30]. But this review did not discuss the optimal anatomical sites for RD measurement or whether the patient should be at rest or at active contraction. Two additional studies[32,33] have been published since this review. One study[32] investigated intra-rater reliability of IRD measurement using ultrasound imaging in postpartum women with RD. Reliability of the measurement was high, particularly when measuring at or above the umbilicus. Reliability coefficients were poorer when measuring the IRD below the umbilicus[33]. Another study[34] found no significant differences in the IRD measured by ultrasound imaging at the umbilical level or at 3 and 5 cm above. Furthermore, the same study found that the IRD was slightly decreased during active curl-up compared with resting in patients with RD[34]. Gillard and colleagues[24] measured the IRD by ultrasound imaging in 41 women at 8 weeks postpartum, and found that the IRD was wider while standing and sitting compared with lying.

There is no clear answer as to whether the IRD should be measured during active muscle contraction or at rest. It seems that in patients with RD, especially in parous women, the IRD decreases slightly when measured during active contraction[33,34]. However, one study[34] did report greater measurement errors during active curl-up. This might be explained by variation in the intensity of muscle contractions between measurements[34].

The optimal site for measuring the width of the linea alba is also unclear. Several different sites have been suggested: at umbilical level, 2, 3, 4.5, 5, 9, and 12 cm above the umbilicus; 2, 3, 4.5, and 5 cm below the umbilicus; halfway between the umbilicus and the xiphoid process; and halfway between the umbilicus and the pubic symphysis[30,32–35]. However, it seems clear that the widest IRD is measured at umbilical level, followed by the area within 5 cm above the umbilicus[24,32,33,35]. Furthermore, the same studies reported uncertainties in measurements below the umbilicus, possibly owing to a thinner rectus sheath, more subcutaneous fat or loose skin in that area.

The Guidelines Group suggests the use of clinical examination for diagnosing RD, and the use of ultrasound or calipers at 3 cm above the umbilicus to provide repeatable and accurate measurement of the IRD.

KQ3 What are the classification systems for RD?

Statement: None of the existing classification systems seems to be optimal for classifying RD or to serve as a basis for treatment strategy.
Recommendation: A new classification system for RD is suggested based on the width of muscle separation, postpregnancy status, and whether or not there is a concomitant hernia (*Fig. 1*).
Quality of evidence: Low
Strength of recommendation: Strong (upgraded)

In 1990, Ranney[36] proposed a classification of RD based on IRD. A width of less than 3 cm was classified as mild, 3–5 cm as moderate, and a separation of over 5 cm as severe diastasis.

In 2001, Nahas[37] proposed a further classification system for RD based on the aesthetics of the abdomen and myoaponeurotic deformity: type A—RD secondary to pregnancy with a well defined waistline; type B—RD secondary to pregnancy with laxity of the infraumbilical and lateral aponeurotic layers; type C—congenital lateral insertion of the rectus abdominis muscles on the costal margins, often with a concomitant umbilical or epigastric hernia; and type D—RD and poor waistline.

A specific treatment strategy was suggested by Nahas[37] for each RD type: type A—plication of the anterior sheath alone; type B—plication in combination with L-shaped plication of the external oblique aponeurosis; type C—release of posterior rectus sheath in combination with advancement of the muscles to the midline; and type D—plication and advancement of the external oblique muscles.

Recently, a new classification system was proposed by Reinpold and colleagues[38], based on the width and length of the diastasis, and whether there is a concomitant ventral hernia or not. The width of the diastasis is graded as mild, moderate or severe, whereas the length is classified according to the EHS classification system of midline hernias; that is, involving subxiphoidal, epigastric, umbilical, infraumbilical or suprapubic areas. Furthermore, it should be noted whether there is a concomitant umbilical, epigastric, port-site or incisional hernia. Additional factors to consider include whether the patient has had any previous abdominal operations within the width and length of the diastasis, the number of previous pregnancies, and the presence of skin laxity. They also advised to register preoperative pain at rest and during physical activities.

However, the association between the width and length of the diastasis and symptoms is not clear, but accurate measurement of width will still be of interest when trying to make comparisons in the research setting.

In summary, a classification system for a specific condition should optimally relate to the outcome of the suggested treatment strategy and should be easy to use. None of the existing classification systems seem to achieve these goals, and so a new classification system is proposed by the Guideline Group (*Fig. 1*) based on measured width of the IRD, postpregnancy status, and presence or absence of a concomitant hernia. Even though the level of the evidence is low, the Guideline Group believes that the recommendation should be strong.

KQ4 What symptoms are associated with RD?

Statement: A range of symptoms is reported to be associated with RD. It is unknown whether the width of the diastasis is related to the severity of symptoms. Impaired body image and core instability seem to be the most common symptoms.
Recommendation: As a clinical expertise guidance, impaired body image and core instability appear to be the most relevant symptoms to report on and to investigate in future studies.
Quality of evidence: Low
Strength of recommendation: Weak

A list of common symptoms was compiled, based on a systematic review and explorative reading of the literature (*Table 1*)[20,39–51]. Symptoms of RD were most commonly explored in relation to the IRD in postpartum women.

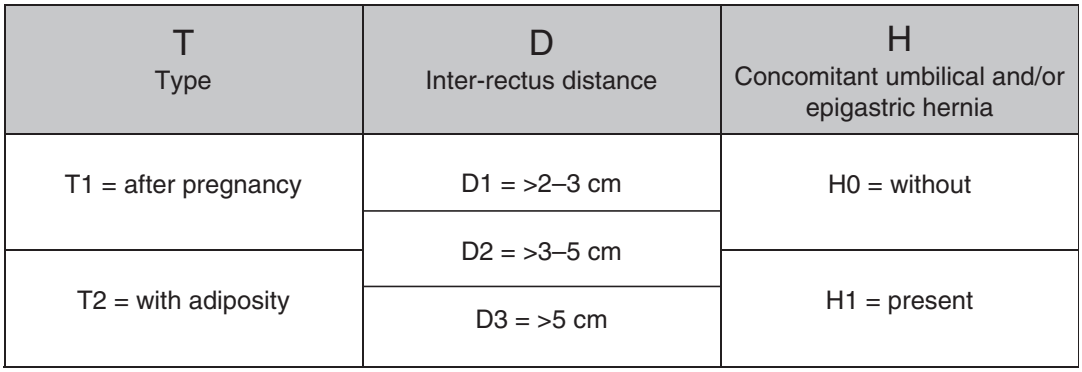

Fig. 1 European Hernia Society RD classification

Table 1 Overview of frequently reported symptoms related to RD

Body image	Bulging belly
	Outie belly button
	Mummy tummy
Core instability	Movements
	Breathing problems
Pain	(Low) back
	Hip
	Pelvic
	During sex
Pelvic problems	Faecal incontinence
	Urinary incontinence
	Organ prolapse
Intestinal problems	Constipation
	Bloating

Body image was the subject of four studies (*Table S1 in Appendix S2*). Keshwani and colleagues[39] used the multidimensional body self-relations questionnaire in 32 postpartum women with diastasis. They found a significant inverse relationship between body image and IRD. Gitta and co-workers[40] observed significantly lower Short Form 36 (SF-36®, RAND Corporation, Santa Monica, CA, USA) scores in women with RD compared with those without in a cohort of 200 postpartum women. Body image was measured using a visual analogue scale (VAS) for scar tissue by Bellido *et al.*[41]. An increase from 2.8 to 8.3 on a 10-point scale was found 1 year after RD repair. Similarly, Olsson and colleagues[42] used SF-36® to assess and demonstrate significant improvement in quality of life (QoL) after diastasis repair, further emphasizing the impact of diastasis on body image.

Core instability was discussed in four studies (*Table S2 in Appendix S2*). Hills and co-workers[43] evaluated trunk muscle function, self-reported pain, and low back dysfunction in women with and without diastasis at 12–14 months postpartum. Diastasis was associated with poorer trunk rotation strength and lower scores on ability to perform a sit-up. Gunnarsson *et al.*[44] investigated the relationship between diastasis width and abdominal function in 57 patients, using a Biodex system (Biodex® Inc., Shirley, NY, USA) for measurement of muscle strength. A strong correlation was found between intraoperative diastasis width and flexion as well as isometric abdominal muscle strength. Liaw and colleagues[45] investigated the relationship between IRD and muscle strength in 40 postpartum women and 20 nulliparous counterparts, and observed a negative correlation between muscle strength test and IRD. In a recent study by Olsson *et al.*[42], a group of patients with therapy-resistant symptoms of core instability used an Abdominal Trunk Function Protocol, which included the Disability Rating Index and eight trunk function tests. Patients experienced a significant increase in performance of 76 per cent after surgical repair. All studies focusing on core instability noted a significant influence of RD.

Pain was analysed in eight studies[20,39–41,46–48,51], half of which focused on the peripartum period (*Table S3 in Appendix S2*). Goncalves and co-workers[46] measured pain using a verbal descriptor pain scale. Others[40,41,47,49] distinguished between abdominal, lumbar/pelvic, and low back pain. Conflicting results were reported that showed no significant correlation between pain and RD. It was hypothesized in the study by Doubkova *et al.*[47] that the relationship between diastasis and chronic low back pain is mediated by a higher BMI, confirmed by a stronger correlation. However, overall, pain does not seem to be a significant problem in patients with RD.

Among pelvic problems, urinary incontinence was the most investigated symptom[39,40,42,48–50] (*Table S4 in Appendix S2*). QoL questionnaires, including the Short Form of the International Consultation on Incontinence Questionnaire—Urinary Incontinence (ICIQ-UI-SF) and scales on the Pelvic Organ Prolapse Quantification System (POP-Q), were used. Of 13 different studies of urinary problems, three[40,42,48] reported a significant relationship with RD. One year after diastasis repair in 60 patients, Olsson and colleagues[42] showed significant improvement in scores on the Urogenital Distress Inventory 6 and Incontinence Impact Questionnaire 7. Faecal incontinence was included in a cross-sectional study of 541 participants[48] and was observed to be twice as frequent in patients with diastasis. However, this correlation was not significant, and incontinence may not be meaningfully related to diastasis alone.

In summary, a range of symptoms is encountered in patients with RD. Only a few of these are found to be related to measured IRD. The most relevant symptoms seem to be disturbance in body image and core instability.

KQ5 Which outcome measures should be used to evaluate treatment for RD?

Statement: Studies describing outcome measures are very limited. The inter-rectus distance may be an objective measure, although the correlation with clinical presentation is unclear. Patient-reported outcome measures are the best tool to evaluate clinical symptoms, such as body image and core instability. The Short Form 36 and Body Image Questionnaire are helpful.
Recommendation: It is suggested that future studies should focus on core instability and body image.
Quality of evidence: Low
Strength of recommendation: Weak

Several studies evaluated treatment options for RD by reporting on the width of the linea alba or IRD as one of the outcome variables. Both the diagnostic modality and the techniques used to evaluate this variable differed, without consensus in the literature. Some studies[52] reported a value for IRD (in centimetres or millimetres) after surgery. Others used the definition of RD given by Rath and colleagues[28] based on age (below or above 45 years) or that proposed by Beer *et al.*[27] (normal width of linea alba in nulliparous women). Mestak and co-workers[53] investigated the long-term stability of the rectus sheath after plication by means of ultrasound imaging, and compared the postoperative IRD with that measured in non-operated nulliparous women. Ultrasonography was also used by van Uchelen *et al.*[54], who studied the IRD before and after plication. Tadiparthi and colleagues[55] evaluated the IRD before and after surgery, and observed a reduction in this parameter at 12 months after operation. However, they did not correlate the IRD reduction with any clinical improvement in symptoms. Benjamin and co-workers[56] evaluated the relationship between IRD and the severity of low back pain, lumbopelvic pain, incontinence, pelvic organ prolapse, impaired abdominal performance, and impaired health-related QoL. Overall, no clear relationship emerged between clinical presentation and IRD. The same was concluded by Emanuelsson *et al.*[57], who compared double-row plication with retromuscular mesh placement; no correlation could be found between a reduction in IRD and improvement in patients' clinical complaints.

Abdominal wall function can be very difficult to measure and does not seem to be as clearly associated with symptomatology as core instability. Gunnarsson and colleagues[44] studied the correlation between RD and abdominal muscle strength in 57 patients using CT. They observed that abdominal flexion and isometric workload correlated strongly with the IRD between the umbilicus and symphysis. This was confirmed in a similar study by Liaw and co-workers[45] using sit-up testing. Olsson *et al.*[42] reported on the effect of surgical repair of symptomatic diastasis in relation to abdominal trunk function. They used an Abdominal Trunk Function Protocol including the Disability Rating Index and seven function tests, evaluating back muscle strength, abdominal muscle strength, and lateral and ventral trunk stability. The results showed that 98 per cent of women reported fewer problems after surgery. When evaluated by a physiotherapist, 76 per cent demonstrated significantly better performance. However, the mean abdominal strength had not improved by 1-year follow-up.

Health-related QoL as a useful outcome measure was reported by Emanuelsson and co-workers[57] using the SF-36® questionnaire. Pretreatment results showed lower scores in all eight domains for patients with RD compared with age-matched controls. Follow-up at 1 year after surgical repair showed scores similar to those of the Swedish norm population in all domains. Using the SF-36®, Olsson *et al.*[42] evaluated QoL after a double-row plication and showed similar improved outcome for all domains compared with the general population.

Seroma formation is a common complication after surgical correction of diastasis but, in terms of outcome measurement, this short-term complication is of limited value. Akram and Matzen[58] published a systematic review reporting on postoperative complications, with seroma formation being the most frequently observed (range 0–25 per cent).

Recurrence after RD treatment is difficult to define as it is dependent on the definition of recurrence and which classification is used. Most studies of surgical treatment included recurrence as an important outcome, although published rates vary widely. Bulging is reported infrequently.

Functional symptoms related to RD are the most important patient-reported outcome measures, and include decreased core stability, low back pain, pelvic pain, urinary incontinence, and health-related QoL. Ideally, objective assessment of these complaints should be made before and after treatment in order to obtain comparable results between studies. Several questionnaires have been validated over time to assess different symptoms: VAS, Modified Oswestry Low Back Pain Disability Questionnaire, POP-Q, ICIQ-UI-SF, SF-36®, and the Ventral Hernia Pain Questionnaire[57].

In conclusion, the IRD seems to be an objective measure, although it correlates poorly with clinical symptoms. Patient-reported outcome measures are the best tool to evaluate clinical symptoms such as body image and core instability. The SF-36® and Body Image Questionnaire seem helpful.

KQ6 Are there non-operative treatment options for RD?

Statement: There is limited evidence to support a benefit from non-operative treatment. Physiotherapy seems to reduce inter-rectus distance. Several different training programmes have been described but no specific regimen can be recommended. It is unknown whether symptoms and quality of life can be improved using a specific exercise programme.
Recommendation: No specific non-operative treatment for RD can be recommended. However, physiotherapy may be considered prior to surgical management of the rectus diastasis.
Quality of evidence: Moderate
Strength of recommendation: Weak

Non-operative treatment options include the following.

No treatment, await spontaneous resolution

The literature is sparse in this regard. Two studies[18,58] monitored the association between RD and pregnancy, and observed that RD was related to pregnancy and persisted. If natural resolution

and maximal recovery of RD is to occur, it takes place between 1 day and 8 weeks after delivery, after which recovery plateaus[18].

Physiotherapy and training programmes

The aims are to reduce IRD and to improve QoL. Four systematic reviews[58–61] investigated the role of physiotherapy in managing RD. All concluded that physiotherapy may be an option to reduce IRD for patients unable or reluctant to undergo surgical intervention. However, the optimal exercise regimen is unknown. Five RCTs[57,62–65] and three prospective cohort studies[66–68] were identified (*Table S1 in Appendix S3*). One RCT not included in the systematic reviews was that of Thabet and colleagues[65], which compared two groups of 20 patients each, one treated with deep core stability exercises and the other with traditional abdominal exercises. After 8 weeks, the IRD decrease was greater and, in addition, the QoL improved significantly, in the group treated by means of deep core stability exercises. The observational study by Vaishnavi *et al.*[68], which was not included in any of the systematic reviews, evaluated the effect of specific exercises over 6 weeks in 15 women with RD, and demonstrated a significant decrease in IRD.

On initial inspection, the evidence appears to support the role of exercise in limiting the effect of RD. However, there are limitations to drawing meaningful conclusions from these studies. In the first instance, patient numbers are small and interpretation may be further compromised owing to the marked variation in design. The types of exercise, duration of training, follow-up periods, and even methods of IRD measurement differed widely between studies (*Table S1 in Appendix S3*). Considering these drawbacks, the Guidelines Group cannot make any recommendation on the use of physiotherapy and the optimal type of exercise.

KQ7 What are the surgical treatment options in patients without concomitant hernias?

Statement: Rectus diastasis without concomitant midline hernias can be surgically treated using linea alba plication (suture) with or without mesh augmentation, both via an open or a laparoendoscopic approach. Studies comparing different options are scarce, heterogeneous and of low quality.

Recommendation: If surgery is performed, the used technique should result from a shared decision-making process between patients and surgeons. As a clinical expertise guidance, linea alba plication is suggested in patients without concomitant hernia. No recommendation on the type of suture or suturing technique can be made.

Quality of evidence: Low

Strength of recommendation: Weak

Two main options for the surgical management of RD without concomitant midline hernia were identified: linea alba plication (suture) without mesh augmentation, and linea alba plication with mesh augmentation, both by an open or laparoendoscopic approach. This information comes from both observational studies and RCTs (*Table S1 in Appendix S4*). Three main postoperative outcomes were reported in these studies: recurrence of RD, postoperative complications, and QoL. Very few studies looked at the effect of surgery on QoL.

Linea alba plication (suture) without mesh augmentation

Patients with RD alone (without hernias) were assessed in three RCTs[57,69,70]. Birdsell and colleagues[69] compared open plication of RD in 30 patients using polyglycolic acid *versus* a nylon running suture, with no recurrence in either group after 6 months of follow-up. Emanuelsson *et al.*[57] compared RD repair in 28 patients using open plication with a barbed absorbable running suture, among whom there was one recurrence at 1-year follow-up, *versus* 29 patients with plication and mesh reinforcement, in whom there was no recurrence. QoL improvement was the same in both groups. Gama and co-workers[70] evaluated 30 patients in three groups; the first underwent open plication with a double layer of nylon suture (first interrupted and second running suture), the second had repair with an open single-layer plication of continuous nylon suture, and the third underwent repair using a single-layer plication with a continuous non-absorbable barbed suture. In this last group, there was a 30 per cent recurrence rate at 6 months, but no comment was made on either postoperative complications or changes in QoL. Heterogeneity in terms of plication methods in these three RCTs precludes pooled analysis as there were no comparable groups.

The remaining studies were observational and completely heterogeneous, differing in method of plication (*Table S1 in Appendix S4*). Briefly, open plication of rectus muscles was employed in nine studies[42,52–55,71–74], including only women. Different types of suture (short- or long-term absorbable, non-absorbable, simple or barbed) and different suture techniques (running, interrupted, single or double layer) were described. The number of patients included was small and follow-up varied between 6 and 81 months. Eight studies[42,53,55,71–75] reported no recurrence of RD when the defect was closed using either a non-absorbable or long-term absorbable suture in one or two layers. van Uchelen *et al.*[54] reported a 40 per cent rate of recurrence when a short-term absorbable running suture (polyglactin) in one layer was used in most patients. de Castro and colleagues[52] reported plication using interrupted nylon sutures, and observed a 2.6 per cent recurrence rate at 60 months' follow-up. Only two studies[76,77] reported on the use of an endoscopic or laparoscopic approach; however, they did not report on recurrence.

Linea alba plication with mesh augmentation

The RCT by Emanuelsson *et al.*[57] compared recurrence rates between 28 patients undergoing simple fascial plication and 29 patients treated with open plication in combination with insertion of a retromuscular mesh. At 1-year follow-up, one recurrence was seen in the plication group and none in the mesh group; there was, however, a higher incidence of postoperative complications, such as seroma formation, in the mesh group[57].

The remaining studies describing combined plication with mesh augmentation were observational (*Table S1 in Appendix S4*). Open plication with mesh reinforcement was used in three studies[78–80]. Angio and co-workers[78] reported 12 patients (4 men) in whom plication and onlay polypropylene mesh was used, with no recurrences at 24 months of follow-up, and excellent cosmetic results (82 per cent). However, this study documented a postoperative seroma rate of 25 per cent. Cheesborough *et al.*[79] described repair of RD alone in five patients (2 men) treated with retromuscular polypropylene mesh; no recurrence was reported at 14 months after surgery. Postoperative complications were not reported separately for this group. Shirah and Shirah[80] reported on RD repair in 179 patients (20 men) using retromuscular polypropylene mesh. No recurrence was reported at 24 months'

follow-up, and 95 per cent of the patients were satisfied with the cosmetic result, although the wound infection rate was notable at 6 per cent. Laparoscopic plication with intraperitoneal mesh reinforcement was reported in three studies. Palanivelu *et al.*[81] included 18 patients (5 men) in a study of 'venetian blind' plication with intraperitoneal mesh, and reported no recurrence at 48 months of follow-up. The rate of cosmetic satisfaction was 100 per cent. However, 11 per cent of patients reported chronic postoperative pain. Huguier and co-workers[82] reported a high rate of recurrence, 2 in 10 patients, at a mean follow-up of approximately 15 months; one patient was dissatisfied with the aesthetic outcome. Shirah and Shirah[80] reported on 37 patients (11 men) undergoing laparoscopic mesh repair, with no recurrence at 24 months. However, patient satisfaction was not uniform, with 8 per cent of patients remaining unsatisfied with the cosmetic result after surgery. Of greater concern, 20 per cent of patients reported prolonged postoperative pain.

Summary

The data presented are mostly of low quality and heterogeneous. Accordingly, it is difficult to establish a recommended standard of practice. However, open plication with non-absorbable or long-term absorbable sutures in one or two layers appears to provide a robust repair and a low incidence of recurrence. At the present time, it is problematic to determine or recommend the use of mesh, or make further comments on the type of mesh to be used or its optimal position. It is equally challenging to make an argument for the role of laparoscopic repair. Therefore, the Guidelines Group recommends that the choice of repair requires careful assessment of the patient's concerns, including physical examination, before consideration of the potential benefits and harms of each surgical option, keeping in mind the limited data available to support the choice of a specific method. The Guidelines Group strongly believes that the chosen technique should involve shared decision-making with the patient. *Table 2* summarizes the data in order to aid surgeons in this process.

KQ8 What is the optimal treatment of RD with concomitant umbilical or epigastric hernias?

Statement: Mesh-based repair is recommended according to the European Hernia Society and Americas Hernia Society Guidelines for Treatment of Umbilical and Epigastric Hernias. Plication of the anterior rectus sheath may be sufficient to repair at least the smallest (less than 1 cm) umbilical or epigastric hernias. Other approaches have been reported. The endoscopic subcutaneous dissection followed by linea alba plication with an onlay mesh was the most reported technique.

Recommendation: A mesh-based repair of rectus diastasis with concomitant midline hernias is suggested. Plication of the linea alba may be sufficient to repair a diastasis associated with small (less than 1 cm) umbilical/epigastric hernias.

Quality of evidence: Low

Strength of recommendation: Weak

A concomitant primary ventral hernia transforms the intact fascia of a RD into an interrupted one. This alteration can influence treatment options and thereby outcome. The focus in this KQ is on the combination of both pathologies. Köhler *et al.*[83] evaluated the impact of concomitant RD on the outcome of 231 patients with small umbilical or epigastric hernias who underwent primary suture repair. A significantly higher rate of hernia recurrence was observed in the 93 patients with a concomitant RD. They recommended checking for RD before operation in patients with primary ventral hernias and to use a mesh-based technique in this situation.

A total of 15 studies reported the management of RD combined with concomitant hernias (*Table S1* in *Appendix S5*). Overall, the outcome was successful with a low recurrence rate. Studies with comparable approaches are discussed briefly below.

Endoscopic subcutaneous dissection with plication and onlay mesh technique

Barchi and co-workers[84] described use of SVAWD (subcutaneous videosurgery for abdominal wall defects). Hernia defects (mean size 7.5 cm) were closed with a running barbed suture and the RD corrected with plication of the medial edges of the anterior rectus sheath. A large onlay polypropylene mesh provided reinforcement and was fixed with either biological glue or absorbable tacks. The authors concluded that their technique provided an effective correction as there were no major complications or recurrences. Seventeen of 21 patients had concomitant RD; however, the results were not discussed separately.

Claus *et al.*[85] used another acronym (SCOLA, subcutaneous onlay laparoscopic approach) for the same approach. Forty-eight patients were treated (4 using a robotic platform), 45 with mesh reinforcement. One recurrence was observed in one of three patients treated without mesh.

Juárez Muas[86] used the same technique (named REPA, preaponeurotic endoscopic repair) for symptomatic patients with midline defects associated with RD. They reported no recurrence after 50 procedures and mean follow-up of 23 months, with a patient satisfaction rate of 96 per cent.

Köckerling *et al.*[87] reported on a hybrid technique called ELAR plus (endoscopic assisted linea alba reconstruction in combination with mesh augmentation) in 140 patients. The reconstruction was performed by suturing the medial parts of both anterior rectus sheaths with a non-absorbable suture including the hernias. An onlay mesh (TiMesh strong [TiMesh® pfm medical, UK Ltd, UK]) was used for augmentation. A total of 21 per cent of patients were reviewed at 1-year follow-up, with no recurrence reported in this subset.

Köhler and colleagues[88] introduced MILAR (minimally invasive linea alba reconstruction) with onlay mesh placement of a fully long-term absorbable synthetic mesh. Two retractors were used instead of laparoendoscopic equipment. At 5 months' follow-up, no recurrence was seen in the cohort of 20 patients.

Endoscopic dissection with plication and sublay mesh technique

Li *et al.*[89] introduced an approach to the retromuscular plane by totally endoscopic sublay repair. The posterior rectus sheaths were reapproximated in the midline with a running barbed suture in the cephalocaudal direction (including the peritoneal breach). A mesh was placed in the retromuscular space without fixation. The anterior rectus sheaths were closed in the same way. They reported short-term results for 26 patients with different types of hernia, but only eight of these had a concomitant RD. No recurrence was noted after a mean follow-up of 9 months.

Table 2 Data for helping in shared decision-making (KQ7) for patients with RD without concomitant hernias

Approach	Layers	Type and suture	No. of studies	No. of patients	Recurrence (%)	Follow-up (months)	Complications
Without mesh							
Open	One-layer plication	Non-absorbable continuous suture	4[55,69,70,75]	75	0	6–25	n.r. in 3 studies 3% wound dehiscence in 1
		Non-absorbable, continuous barbed suture	1[70]	10	30	6	n.r.
		Short-term absorbable continuous suture	2[54,69]	78	0–40	6–64	n.r. in 1 71% skin hypoaesthesia 1.6% DVT
		Long-term absorbable continuous suture	1[53]	44	0	12	n.r.
		Non-absorbable interrupted suture	1[52]	38	2.6	60	1 haematoma (reoperation) 2 seroma
	Two-layer plication	Non-absorbable suture	3[70–72]	32	0	6–81	n.r. in 2 8.3% seroma in 1
		Long-term absorbable	3[71,73,74]	39	0	6–40	n.r. in 2 5.8% seroma in 1
		Long-term absorbable barbed suture	3[42,57,74]	60	0–4	12–34	5.8–18% wound infection 11.6–14% seroma
Laparoscopic	One-layer plication	Non-absorbable interrupted suture	1[76]	85	n.r.	n.r.	1.2% wound infection 7% seroma
	Two-layer plication	Non-absorbable continuous suture	1[77]	88	n.r.	66	10.2% ecchymosis 3.4% seroma
With mesh							
Open	One layer + retromuscular mesh	Long-term absorbable continuous suture	1[57]	29	0	12	31% wound infection 17% seroma 7% haematoma
		Non-absorbable interrupted sutures	2[79,80]	184	0	14–24	6% wound infection 5% seroma 3% haematoma
	One layer + onlay mesh	Non-absorbable interrupted sutures	1[78]	12	0	24	25% seroma
Laparoscopic	One layer + IPOM mesh	Non-absorbable continuous suture	2[80,81]	55	0	24–48	21–11% pain 8% foreign body sensation
		Not specified continuous suture	1[82]	10	20	15	10% haematoma 10% fat necrosis

n.r., Not reported; DVT, deep vein thrombosis; IPOM, intraperitoneal onlay mesh.

Fiori and colleagues[90] described the same technique, TESAR (total endoscopic sublay anterior repair) in 26 patients with RD, 16 of whom had a concomitant umbilical hernia. No recurrence was observed and QoL showed improvement at 1-year follow-up.

Carrara and co-workers[91] developed an endoscopic technique using a mechanical linear stapler, introducing each branch inside both rectus sheaths from the umbilicus in the cranial direction. The two rectus sheaths were then sutured together in two lines, anterior and posterior, and a synthetic mesh was placed in the retromuscular space. No recurrences were reported in 14 patients with midline hernias and RD at 6 months' follow-up.

Bellido *et al.*[41] included 21 patients with midline hernias and RD. They repaired the hernia with a mesh in the preperitoneal space, and performed a subcutaneous endoscopic dissection with plication of both aponeuroses with a continuous non-absorbable barbed suture. There were no recurrences at a mean of 20 months' follow-up and a substantial improvement in back pain was noted.

Open dissection with sublay mesh technique

Cheesborough and colleagues[79] described a mesh-reinforced midline repair (polypropylene mesh positioned in the rectrorectus plane), combined with standard abdominoplasty. Thirty-two patients were reviewed retrospectively, 27 with a midline hernia and RD. After an average of 471 days' follow-up, none of the patients had developed a recurrent midline bulge or hernia.

Bezama[92] presented a new minimally invasive technique for repair of an umbilical hernia with associated RD (smaller than 4 cm) in 36 patients. A small supraumbilical incision was made and the preperitoneal space was dissected. Polypropylene mesh was inserted with the aid of retractors, covering the diastasis and the hernia defect. No plication was performed. No recurrences were recorded at 1-year follow-up that included all patients. Privett and Ghusn[93] described the same technique as Bezama, but using a self-adhesive mesh. A total of 58 patients with an umbilical hernia smaller than 4 cm and RD were treated. One recurrence was reported at 2-year follow-up.

Yurasov *et al.*[94] investigated the short-term outcomes of surgical treatment of 234 patients with umbilical hernia combined with RD. A retromuscular polypropylene mesh was placed in 175 patients after suturing the posterior sheaths together, including the umbilical hernia, with a non-absorbable suture. The anterior rectus sheaths were then closed. No recurrences were described in this group. Two recurrences were reported among 59 patients who underwent sutured repair of the hernia and RD without using a mesh. The duration of follow-up was not specified.

Open dissection with onlay mesh

Tuominen and colleagues[95] described a technique named PSUM (plication supported by mesh) using a 2-cm strip of autoadhesive polypropylene mesh over the diastasis, followed by plication of the two rectus sheaths with monofilament nonabsorbable

sutures. They reported outcomes in 34 patients with RD, 19 associated with midline hernias. One recurrence developed after a mean follow-up of 13 months; high patient satisfaction and improvement in body balance was reported at 1 year in 92 per cent of patients. However, results for patients with or without concomitant hernia were not reported separately.

Repair of large umbilical hernias in patients with RD during simultaneous abdominoplasty was described by van Schalkwyk *et al.*[96]. An intraperitoneal mesh was used in 10 patients to support umbilical hernia repair using a laparoscopic approach, followed by RD repair with a barbed suture and a standard abdominoplasty. No recurrence was noted at 1-year follow-up.

Summary

In conclusion, a mesh-based repair is suggested to repair RD with concomitant midline hernias. Plication of the linea alba may be sufficient to repair a diastasis associated with small (less than 1 cm) umbilical or epigastric hernias. Minimally invasive approaches are in their infancy and further studies in this area are needed. The variety and heterogeneity of techniques used, the small number of patients of each study, the absence of comparative studies, and the low quality of the evidence obtained prevent elaboration of any recommendation regarding the best approach or the type and position of mesh.

KQ9 Is there a role for specific postoperative management of RD repair?

Statement: Abdominal binders appear to aid mobilization, and reduce postoperative pain and psychological stress. They have no effect on seroma formation or pulmonary function. No specific postoperative rehabilitation programme is used worldwide.
Recommendation: As a clinical expertise guidance, the use of an abdominal binder in postoperative period can be suggested. The noted advantages of reduced pain, enhanced mobilisation, and their perceived psychological support after surgery, make their contribution modest but of value. No specific postoperative rehabilitation programme can be recommended.
Quality of evidence: Very low
Strength of recommendation: Weak

Several measures are employed routinely in the postoperative management of patients undergoing RD repair. Among the most common is the use of a compressive binder. Binders may be offered to provide immobilization of the operative site in order to limit discomfort, seroma formation, and aid mobilization. No specific evidence has been found regarding when to recommend the use of abdominal binders after RD repair. The literature on the use of binders in the postoperative setting, from systematic reviews to RCTs, is based on patients undergoing abdominal surgery[97–99]. The duration of use of a binder varies between 3 days and 1 month. In the systematic review by Rothman and colleagues[97], including eight studies with more than 500 patients, it was concluded that abdominal binders may reduce postoperative psychological stress, but the effect on postoperative pain and seroma formation remains unclear.

In most studies of surgical treatment of RD, the authors recommended the use of a postoperative abdominal binder for a variable period of time, from 10 days to 12 weeks after surgery[45,48,54,77,80,81,86,90,95,100]. There are no studies comparing the use of binders *versus* no binder after surgical treatment of RD. As clinical expertise guidance, binders can be suggested after RD repair as long as no harm is derived from their use.

Another common recommendation suggests avoiding heavy lifting (more than 5 kg) in the initial 4–6 weeks after abdominal surgery, but there is no evidence supporting this recommendation.

Specific physiotherapy treatment or exercise in the postoperative period has been investigated sparsely. Olsson and co-workers[42] recommend that their patients follow a standardized rehabilitation programme developed by the physiotherapy department. Based on the very low quality of the evidence, no recommendation on postoperative rehabilitation programmes can be given.

Comments

The literature on RD is relatively limited, and largely confined to the field of plastic surgery. However, an increasing number of studies describing the use of minimally invasive techniques are emerging in the general surgical literature, which reflect growing interest in the management of diastasis using novel methods and specialties. The level of evidence available to answer all the KQs in these guidelines has exposed significant gaps in current knowledge. The quality of most studies is low or very low, as the majority are limited case series and retrospective studies. It has been difficult to set recommendations for most of the KQs. Most of the recommendations given are weak. This is the most important limitation of these guidelines. Other limitations are the non-participation of other stakeholders (physiotherapists, policy-makers, and providers) and patients in the development of these guidelines.

RD is defined as a widening of the linea alba exceeding 2 cm. The presence of a diastasis, and its extent, can be diagnosed clinically and assessed in most patients, but the use of calipers or ultrasound imaging is recommended for exact measurement. A new classification system for RD is proposed based on the IRD, postpregnancy status, and the presence of any concomitant hernias (*Fig. 1*).

Body image and core instability seem to be the most important concerns for patients with RD. Another limitation of these guidelines is that the definition of body image (a multidimensional construct encompassing self-perceptions and attitudes regarding onés physical appearance) is unclear, and there are numerous methods and scales directed at grading or quantifying a patient's perception of their physical self[101]. Moreover, core stability and its components (abdominal trunk function, muscle strength, and endurance) are difficult to assess in an objective manner.

Recurrence was the most frequent outcome reported in studies concerning surgical and non-surgical treatment of RD; data on patient-reported outcomes are lacking and only few studies reported on them.

Physiotherapy or non-surgical treatment of RD is popular; however, there is very limited evidence for its benefit[102]. According to the Guideline Group, physiotherapy could be the first step of treatment, before surgical management of the RD, although no specific exercises can be recommended. Recently, the Swedish Surgical Society[103] published a document (guidelines) about the management of RD, recommending physiotherapy in the first instance.

The type of the surgical intervention for a simple RD should involve a shared decision-making process between the surgeon and patient, balancing the benefits and harms of different options. However, open plication with non-absorbable or long-term absorbable sutures in one or two layers appears to be effective, and is associated with a low failure rate[42,52,53–55,57,69,70,71–74]. Questions regarding the use of a minimally invasive approach and the use of mesh, including its type and position, remain unsolved.

Questions remain too about the optimum management of patients presenting with RD and concomitant hernias. At the present time, the Guidelines Group recommends a mesh-based repair, in line with the EHS and AHS Guidelines for Treatment of Umbilical and Epigastric Hernias published in 2020[5]. Plication of the linea alba may achieve both repair of RD and small (less than 1 cm) associated umbilical/epigastric hernias. Laparoendoscopic and robot-assisted techniques may represent an alternative, but their role needs further study and clarification.

Whether RD with a concomitant hernia should be repaired using mesh for both the diastasis and the hernia, or only for repair of the hernia defect also remains to be elucidated. No comparative studies have been undertaken on this subject; some recommend 'total' repair (RD and hernia) with mesh in patients with multiple midline hernias[84] or in those with a hernia defect wider than 2 cm[85–88,92,93], and others employ mesh only for repairing the hernia itself[41,96]. The Swedish Surgical Society[103] suggests plication of the linea alba as the first-choice surgical technique.

Binders may aid postoperative mobilization and pain control, but there is no published evidence to support their use. The use of binders for a variable period after surgery does not appear to be harmful, and several authors[45,48,54,77,80,81,86,90,95,100] recommend their use after surgery. Accordingly, as clinical expertise guidance, the use of a binder as a supportive measure after RD repair can be suggested.

Barriers to implementation of these guidelines could be the different healthcare policies in different countries. In several countries, there is no financial cover for the surgical repair of RD presenting as a solitary condition; correction is mostly undertaken during abdominoplasty by plastic surgeons in private practice. If more patients were to undergo surgery for RD repair, or more expensive surgical treatments were used in the repair, the cost of healthcare in the public setting for this kind of patient would probably increase. Until new research output is available, management and treatment strategy options need to be discussed adequately with patients to assist them in making informed decisions and understanding as much as possible about the procedures they are agreeing to.

Before submission of the manuscript, the guidelines were evaluated and scored using the AGREE II instrument by two external reviewers. The results of these assessments are presented in *Appendix S6*. It is planned to present these guidelines in a special session at the next AHS–EHS joint congress in Copenhagen, in October 2021.

An update of these guidelines is intended to take place in 2023. The methodology for the update is planned to be similar to that for development of the present guidelines, with the search strategy including articles published from October 2020 onwards.

Perspectives

Ideally, the optimal management of RD should be further elucidated in RCTs. These types of investigational study are difficult to perform in surgery and it takes a long time to get results. An alternative may be the establishment of an international registry that incorporates a large number of patients in order to compare different surgical techniques for important patient-related outcomes. Such a large database may also prove helpful in evaluating different and novel surgical approaches launched.

Funding

These guidelines were prepared by an investigator-initiated collaboration, supported by the EHS. The EHS Board had no role in the design or conduct of the study, collection, analysis and interpretation of the data, or preparation, review or approval of these guidelines. Final decisions regarding the key questions or other issues that arose during the guidelines development process were solely the responsibility of the Guidelines Group.

Acknowledgements

The authors acknowledge external experts for their review and evaluation using the AGREE II instrument of these guidelines before submission of the manuscript: R. H. Fortelny (Department of General, Visceral and Oncological Surgery, Wilhelminespital, Sigmund Freud Private University Medical Faculty, Vienna , Austria) and S. Martínez Cortijo (General and Digestive Surgery, Fundación Alcorcón University Hospital, Rey Juan Carlos University, Madrid, Spain). They also acknowledge the help of E. Grifol Clar, clinical librarian, Fundación Alcorcón University Hospital.

Conflict of interest

P.H.G. has received honoraria for consultancy, lectures, support for travelling, and participation in review activities from BD–Bard and BBraun (direct COI). She is a member of the Advisory Board of Congresses of the EHS and coordinator of the Spanish Register of Incisional Hernia (EVEREG) (indirect COI). N.A.H. has received speaker fees from Medtronic (direct COI), and is a member of the Danish Hernia Database steering committee and has attended an industry-sponsored meeting (indirect COI). F.B. has received speaker fees from Medtronic, BD–Bard, and Acelity (direct COI), and is a member of the advisory board of Medtronic. He is an advisory board member for science of the EHS (indirect COI). D.C. has received speaker fees from Baxter and W. L. Gore (direct COI), and is President of the Italian Society of Hernia and Abdominal Wall Surgery (indirect COI). M.L.-C. has received honoraria for consultancy, lectures, support for travel, and participation in review activities from BD–Bard, Medtronic, and Gore (direct COI). He is also a member of the EHS Board and coordinator of EVEREG (indirect COI). D.R. has received payments as coordinator of Abdominal Wall Reconstruction Europe (indirect COI). A.M. is a member of the steering committee of the Swedish Hernia Register and president of the EHS (indirect COI).

Disclosure. The authors declare no other conflict of interest.

Supplementary material

Supplementary material is available at *BJS* online.

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