

SPORTS INJURY BULLETIN

PREVENTION • TREATMENT • REHABILITATION

Post-operative rehab

Sport after abdominal surgery

With diligent work, says **Adrian March**, a return to former activity should be perfectly possible

While there is a good deal of literature and advice available to women returning to activity after Caesarean delivery, the same cannot be said of many other procedures requiring abdominal surgery. Here is a run-down of how some of the more common procedures can affect the active or sporting individual, particularly in terms of rehabilitation and any subsequent limitations to participation.

Range of surgical incisions

Any abdominal surgery is bound to affect the abdominal musculature to some extent, as the surgeon has to gain access to the interior. Some procedures use laparoscopy (keyhole surgery), which has less effect on muscular integrity. Laparotomy (opening up), which entails a more substantial incision, remains more common, though. The mechanical integrity of the abdominal wall is dependent on rectus abdominis, transversus abdominis, internal and external obliques and the pelvic floor muscles (principally the levator ani). Almost invariably rectus abdominis is most affected, because access for surgery is usually through the front of the abdomen.

Having said this, it is never normal practice for muscle fibres to be cut when making a surgical incision: the aim is to achieve a strong final suturing (stitching), to ensure complete healing with minimal or no loss of strength. To this end, a mid-line incision is often chosen in which the cut is made along the linea alba – the band of fibrous tissue between the two halves of the rectus abdominis which lends itself to strong suturing. A common alternative is the ‘paramedian incision’, about 3cm from the centre line, in which the rectus sheath is cut but the muscle itself is simply retracted⁽¹⁾.

For a patient returning to sport after abdominal surgery, the appropriate rehabilitation programme largely depends on the type of procedure (and therefore the damage

done) during access to the body. We can think in terms of three main types:

- The most straightforward is an internal surgical procedure which has not in itself left a weakness, such as an appendectomy or ulcer repair; complete healing can be expected within a relatively short time.

- The second type is hernia repair. Among sportspeople hernia may occur as a consequence of accident or misadventure. Although in some cases the athlete may be able to make do by using a suitable support, this cannot be regarded as a long term solution: the hernia will never get better, and with age it can be expected to get worse. Modern techniques of hernia repair are very effective, with complete healing, so this must be the preferred solution. The repair site will be reinforced by a specially designed multiple component mesh. Typically, some part of the mesh will dissolve, leaving the remainder to bond intimately with the muscle (for a detailed account see ref 2). The mesh’s presence causes a local change in muscle characteristics and a consequent stress concentration around the mesh’s edge.

Over time, the normal training effect usually results in a correspondingly greater increase of strength in this region, but note that the muscle in the immediate vicinity of the repair is probably being worked harder, be alert to any soreness in this region, and adjust the training load accordingly.

- The third type is where the surgeon creates a ‘stoma’, to redirect some of the body’s waste output by bypassing the normal route of expulsion. Depending on where the stoma is made, it is called a colostomy (from the large intestine), an ileostomy (from the small intestine), or, rarely, a urostomy (from the ureters). These procedures are seldom considered in a sporting context, but therapists and trainers alike should be clear that in the absence of any other health condition, the only thing an athlete with a stoma (known as an ‘ostomate’) cannot do is use

the toilet in the way they used to. There are ostomates who participate in American football, dinghy sailing and powerlifting, which all make heavy demands on the abdominal musculature.

Whichever type of stoma is required, normally it will be positioned within the rectus abdominis. The muscle fibres are divided to enable the exit from the bowel to be sewn into the skin, and a gap remains which can never be closed. The ostomate remains permanently at risk from a parastomal hernia – the risk being greatest in the case of a colostomy, which requires the largest opening. With adequate training of the rectus abdominis, though, this risk can be made negligible.

Avoid the Valsalva manoeuvre

Patients who have had abdominal surgery, and ostomates in particular, are usually solemnly warned on leaving hospital not to lift anything heavy (a full kettle often being suggested as a maximum). The underlying message in this advice is to ‘avoid the Valsalva manoeuvre’, which can arise from straining when making an effort – and this applies not just to lifting but also pulling, pushing, twisting or any other movement requiring substantial effort.

The Valsalva manoeuvre is formally defined as ‘forcibly exhaling against a closed glottis’, or, in everyday terminology, ‘holding the breath and straining’. This action significantly increases intra-abdominal pressure and thus may adversely affect any abdominal weakness. In weightlifting the manoeuvre has traditionally been used as a way to strengthen abdominal musculature while minimising the load on the intervertebral discs, but on no account should it be attempted soon after surgery.

A handy rule of thumb for clients here is the ‘grunt rule’: if it makes you grunt, don’t do it, at least not in the early stages⁽³⁾.

The rehab exercises

The client undergoing abdominal surgery should start their rehab as prehab, if at all possible, so that they have done some advance preparation for surgery. This is particularly important if the individual is unable to continue with their normal sporting or activity schedule in the period prior to surgery. The better the condition of rectus abdominis, the easier will be the client's recovery.

After surgery, it is desirable to train the rectus over its full range of movement; this makes isometric exercises inappropriate as they increase strength over a relatively small range, centred on the position in which the contraction takes place⁽⁴⁾. For this reason, I prefer the conventional abdominal curls to 'plank'-type core exercises. The rehab progression outlined below relates to a deconditioned or unknown starting condition, but those who are confident about the strength of their rectus abdominis may move fairly rapidly through the initial stages. Consult the surgeon about how soon after surgery it is safe to begin this rehab; one month would be a very rough general guide.

Abdominal curl

Target muscle: rectus abdominis

Technique

- Lie supine with arms by sides, palms down and knees bent so that fingertips just touch the heels.
- Contract abdominals to curl the back off the floor, shoulders moving towards knees, then lower down again.
- Perform the movement slowly, taking at least 1 second to raise shoulders, 1 second to hold the position and 1 second to lower.
- If you feel any discomfort, start by just easing the shoulders away from the floor and work gradually up to the full movement.
- Aim to work up to performing three sets of 15 repetitions.

Technique tips for instructors

- Ensure the ribcage is moving towards the hips, so that it is definitely the abdominals being worked rather than the hip flexors. Your client can check this easily by placing thumbs on lower ribs and fingertips on hips: as they curl up, the two should move closer together. The pelvis should remain stationary throughout.
- Do not encourage the client to place hands behind head; this puts unnecessary stress on the neck and contributes nothing to the exercise. Increase the effort when appropriate by getting them to place hands beside ears. Ensure they satisfy the grunt rule by breathing out as they curl up.

- The curl forwards should be taken as far as possible without bringing hip flexors into play or allowing the pelvis to move.

The 3-stage progression

Once 3 x 15 repetitions can be performed with no difficulty or muscle soreness, **Stage 1** is complete. Move to a board or bench inclined at about 45°. Again, aim to work up to 3 x 15 repetitions to complete **Stage 2**. For many sports which make no severe demands on the abdominals (and assuming that the obliques and transversus abdominis have also been strengthened – see below), a normal training routine can be resumed.

For more demanding sports it is desirable to progress the inclined bench exercises further, by holding weights up to 10kg, or perhaps 5kg for women, beside the shoulders. The ability to complete 3 x 15 repetitions with a pair of 10kg dumbbells would complete **Stage 3**.

Oblique curl

Target muscles: Abdominal obliques

The obliques are not nearly as important as rectus abdominis from the point of view of abdominal integrity but that is no reason to ignore them, and for this purpose they are conveniently trained with a simple variation of the abdominal curl. Done properly it is quite demanding, so should not be rushed.

Technique

- Lie supine on a horizontal surface, feet flat, knees bent, hands to ears and elbows bent out to sides.
- Curl each shoulder alternately towards opposite knee and back.
- Aim to build up to 3 sets of 15 repetitions.

Technique tip for instructors

- The common instruction to touch the knee with the elbow is likely to be counterproductive, as it can result in a temptation to move the elbow more and the shoulder less.

Progression

For **Stage 2**, use an inclined bench. There is very little point in progressing to using weights at this stage.

Lower abdomen and pelvic floor

After the rectus, the second most important strengthening requirement is the transversus abdominis. This can be done sitting, standing or lying, by drawing the lower abs in towards the spine. Aim for a maximal contraction and hold as long as you can. Length of hold x repeat of contraction should = 100; for instance, perform 10 x 10 second holds if that is your limit, progressing to 5 x 20 second holds and so

on. This can and should be performed every day.

The pelvic floor muscles (principally the levator ani) run from the pubic bone to the base of the spine. Since they form part of the enclosure of the abdominal cavity it is sensible to strengthen them along with the other abdominal musculature – particularly if surgery has involved the perineum, as is typically the case when a permanent stoma is formed. Contract the muscles (the feeling should be of 'lifting' them or, for women, sucking up inside) and hold for 3 to 10 seconds, then relax⁽⁵⁾.

Sport-specific cautions

Weightlifting and powerlifting

Practitioners of these sports usually have the advantage of good rectus abdominis development, but should make sure they are using correct breathing technique. The Valsalva manoeuvre can be used to reduce the compressive force acting on the intervertebral discs during near-maximal efforts, but it is desirable to ensure that the strengthening exercises described above have been fully achieved before adopting this technique. Otherwise, in movements of low intensity, inhalation should coincide with trunk extension and exhalation with trunk flexion (as, for example, in the abdominal curls). In movements of higher intensity, exhalation should coincide with the generation of maximum force⁽⁶⁾.

Golf

A golfer may return to putting even before completing Stage 1 of the abdominal exercises, but vigorous driving should wait until after Stage 2. Even then, a particularly demanding stroke might cause the grunt rule to be breached and this should be recognised as a potential problem source.

Swimming

Swimming is often recommended as a thoroughly safe rehab exercise. After abdominal surgery, though, it needs to be approached with some caution. When swimming in the prone position, all the downward and backward forces applied by the arms and the downward forces applied by the legs have to be resisted by the rectus abdominis, which is worked particularly hard by competitive freestyle swimmers⁽⁶⁾.

In freestyle stroke (front crawl) the arms push down and back, so the resistance of the water gives rise to a reaction on the arms forwards and upwards (Ra; see Fig 1, above). In the same way the legs are alternately pushing down, producing a reaction upwards (Rf; see Fig 1, above).

In the absence of any controlling force,

these two reactions, Ra and Rf, would have the effect of folding the body upwards like a pen-knife, with a hinge at about waist level. This can only be prevented by tension in the rectus abdominis, represented by the dotted line in Fig 1. Although the precise forces vary, a similar effect occurs with all the strokes swum in the prone position.

Because of the key role played by the rectus, enthusiastic swimmers should aim to pursue their abdominal retraining at least up to Stage 2. If intending to return to competition, completing Stage 3 would be highly desirable. Note, too, that turns require the rectus abdominis to work hard and proponents of the 'hitch kick' should take care with their starts. Enthusiastic and competitive swimmers should also remember that breath-holding is involved to some degree in all starts and turns, and this can increase intra-abdominal pressure.

Other points to note in swimming are:

- Freestyle swimmers generally push the rectus abdominis almost to its limit when competing. A competitive swimmer would be advised to reduce the training load if they experience abdominal soreness between training sessions.

- The lack of streamlining in the breast stroke leg action means there are intermittent reaction forces on the legs which have to be resisted. Recreational swimmers with a poor style tend to draw their knees up under the body in the recovery phase of the kick, with the result that the water hits two large vertical obstacles and generates unnecessarily large drag. These forces can be minimised by aiming to lift the feet up towards the buttocks rather than under the body, and keeping the legs within the width of the body (ie, improving the style).

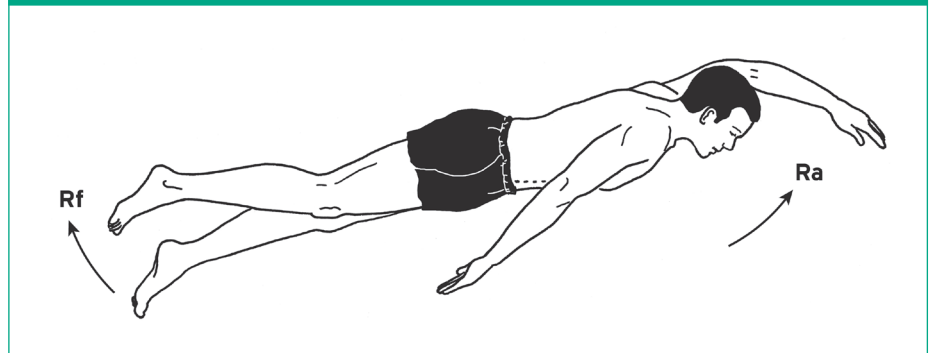
- Back crawl is an excellent choice for swimmers in the early stages following abdominal surgery because the principal reaction forces are resisted by the lower back muscles. It is possible to swim on the back even before Stage 1 of the abdominal exercises has been completed, but the swimmer should take care to avoid too vigorous a tuck when standing up.

- The fundamental advice to anyone wishing to swim butterfly after abdominal surgery is 'don't'. Avoid the stroke until Stage 3 of the abdominal exercises has been completed. After Stage 2 the swimmer might introduce some dolphin kick legs-only work.

Diving

If a diver wants to go back to the way they started to learn, a gentle roll and stretch from a pool-side squat position can do no harm. This can be progressed up to a pike

Fig 1: reaction forces in freestyle stroke



fall from a standing position: simply topple forwards, keeping your eyes fixed on the intended point of entry and your arms pointed towards it. However, the standard advice upon reaching the bottom of the pool ('touch, tuck up and push off to the surface') will require the tuck to be taken up gently, at least until the diver can be confident of the condition of the rectus abdominis. For springboard work and dives that involve taking up tuck or piked positions in the air, Stage 3 of abdominal conditioning is desirable.

Dinghy sailing

Dinghy sailors spend much of their time with half of their bodies out of the boat ('hiking'), supported by rectus abdominis and quadriceps, with rough water shock loads to contend with. Completing Stage 3 abdominal conditioning must be regarded as essential, along with a willingness to accept that some weather conditions may make participation hazardous.

Tennis

Agility requirements may make unexpected demands on the rectus abdominis and it will be worked hard in serves and overhead strokes, in which Valsalva may be a problem. Keen players would be well-advised to take their abdominal conditioning to Stage 2, and professionals to Stage 3.

Running

This should not cause a problem on a good surface, but a slip on rough or uneven ground could cause an overload. If running continues to cause abdominal pain this may be due to adhesions resulting from surgery, and medical advice should be sought. It is wise to avoid cross-country until completion of Stage 2 abdominal exercises; the same level of rehab is needed before resuming serious sprint training.

Riding

Normal hacking should present no problem but jumping demands caution, at least initially, and a respect for the grunt

rule. Unassisted mounting places unquantifiable demands on rectus abdominis; riders would be better advised to use a crate until they have completed Stage 2.

Rowing

While this sport need place no excessive demands on the rectus abdominis, it does involve high-intensity movements in the 'pull' part of the stroke, which may tempt the rower into breath-holding and consequent increases in intra-abdominal pressure. Completion of Stage 2 abdominal exercise is desirable, as is completion of Stage 3 if training for competition. The aim is to exhale during the pull and inhale during recovery.

Contact sports

Only the participant can truly judge the appropriate rehab level for them, but caution is undoubtedly required as there will be unquantifiable uncontrolled impact loads; if in doubt, train up to Stage 3. This group also presents problems for ostomates, who must consider the precautions needed for participation and should also be aware of the embarrassment which may be caused by damage to the appliance worn. If colostomates manage their colostomy by irrigation⁽³⁾ they can be regarded as no different from any other player.

References

1. <http://www.surgical-tutor.org.uk/default-home.htm?specialities/general/incisions.htm~right>
2. <http://www.medscape.com/viewarticle/582009>
3. http://www.stomadata.com/html/everyday_living.htm
4. Knapik, J.J., Mawdsley, R.H., & Ramos, M.U. (1983). Angular specificity and test mode specificity of isometric and isokinetic strength training. *Journal of Orthopedic Sports Physical Therapy*, 5, 58-65.
5. <http://www.mayoclinic.com/health/kegel-exercises/W000119#>
6. Clarys, J.P. (1985) Hydrodynamics and electromyography: ergonomic aspects in aquatics. *Applied Ergonomics*, 16, 11-24.