

The splayed rib: a painful condition with a surgical solution. A report of 5 cases of overstretched intercostal tissue

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INTRODUCTION

Blunt trauma to the chest can result in rib fractures, pneumothorax, pleural effusion or lung contusion. All these conditions are well described and are treated in major trauma centres as well as in community hospitals, if the appropriate expertise is available. The recent addition of the surgical repair of severely displaced rib fractures seems to promise improved respiratory function as well as comfort.

This report presents the cases of 5 patients who experienced linear trauma to the rib cage, especially to the intercostal tissue or chondrocostal junction, with resulting tissue sprain (splayed = stretched). With this condition, patients can suffer from severe pain after movements that exert a pull on the intercostal areas. In the 5 patients this discomfort persisted over several months after their accidents and prevented them from pursuing their usual daily activities. The surgical repair of the sprained tissue resulted in dramatic clinical improvement. This procedure can be done in even the smallest rural hospital with a surgical practice. Patients like these would usually not be treated in tertiary care centres, since the radiologic reports were normal and the patients' conditions seemed to be stable (until they started strenuous work or sport).

The common feature of the 5 patients was that the thoracic trauma was blunt and linear. Their radiographs or computed tomography (CT) scans, if available,

were normal. Magnetic resonance imaging is associated with long waiting lists in remote community hospitals.¹ Therefore, patients with rib cage trauma easily "fall through the cracks" of our strained medical system. They tend to end up in pain clinics, with equally long waiting lists.² On physical examination of the 5 patients, local widening of the intercostal or costochondral areas on compression was noted. Local pressure was painful and showed the connective tissue to "give," although it recoiled.

Much has been reported about painful cesarean delivery scars.³ The consideration to repair overstretched intercostal tissue surgically resulted from my previous experience with ventral abdominal hernias observed in a small community hospital. At times, the patients described locally painful abdominal walls, especially after cesarean delivery, and reported discomfort when straining. There was usually no hernia sac or bulge but, rather, a localized weakening or tenderness of the abdominal wall. CT showed the musculofascial layer to be intact. A simple surgical intervention for these ventral hernias consists of reinforcing the external oblique fascia or underlying muscle layer with gathering nonabsorbable mattress sutures, which alleviates the discomfort.⁴

This principle was now applied to the intercostal tissue. In some cases, the external thoracic fascia was torn (Fig. 1); in another case the intercostal muscles were partially separated from the ribs

(Fig. 2). In the case in which the costochondral junction was splayed (Fig. 3), simple mattress sutures with nonabsorbable material through the cartilage stabilized the area.



Fig. 1. Stretched external thoracic fascia.



Fig. 2. Splayed intercostal muscle.

CASE REPORTS

Case 1

A 39-year-old sailor slipped on a fishing boat and hit his right chest wall against a barrel. He described persisting localized chest wall pain associated with certain movements. He felt unable to continue his work, as the discomfort was too severe. Localized tenderness was found at the cartilage junction of the sixth to the seventh rib at the right chest wall. He went to see his local doctor. His chest radiographs were normal. He was treated with nonsteroidal anti-inflammatory drugs and took a temporary rest. The local discomfort did not settle over the next few months. Eventually he was referred to me.

On examination, faint instability was noted. Our community hospital did not have a CT scanner at the time. Ultrasound findings did not explain the tenderness.

Exploration under general anesthesia showed the connection of the cartilage junction of the eighth and ninth ribs to be torn. This was approximated with 2-0 nonabsorbable sutures. The patient's condition improved, and he returned to light duties after 3 weeks. After another 3 weeks he resumed his regular heavier duties.

Case 2

A 74-year-old woman presented for laparoscopic cholecystectomy and reported 2 types of pain, one after eating greasy food and the other with movement. While roaming the woods, she had fallen onto a sharp rock, bumping the back of her right rib cage. The discomfort with activity prevented her from being the usually active person she was before the accident.

On examination, local weakness and tenderness were found in the intercostal space of the 9th to the 10th rib. Originally, she had sustained a rib fracture and had a small pleural effusion, which resolved with conservative measures. Consequently, radiographs were normal, as was a CT scan. Gallstones had been diagnosed. The patient underwent laparoscopic cholecystectomy and exploration of the tender area. A spread of the external intercostal fascia was found (Fig. 1) as well as a loosened junction of the seventh to the eighth rib; 2-0 nonabsorbable mattress sutures on a cutting needle were used to reapproximate and stabilize the cartilage, and 3-0 resorbable sutures were used for the repair of muscles and fascia. The patient reported great relief postoperatively and was more grateful

for the intercostal repair than for the removal of her gallbladder. When she was admitted for bowel resection surgery 5 years later she did not mention any chest wall pain.

Case 3

A 55-year-old man had undergone reoperative surgery for an anastomotic leak of a Billroth II gastrectomy performed 1 year earlier, when he was emaciated and septic. At the time of reoperation, firm retractors were set in place, which in hindsight might have spread his ribs. He now presented with bilateral tenderness at the anterior junction of the 9th to the 10th rib. This was aggravated by movements when playing golf or tennis (moving his trunk sideways). Local weakness and a gap were felt. The chest radiograph and CT scan were normal. The surgical repair resulted in the disappearance of his symptoms (Fig. 4).



Fig. 3. Splayed chondrochondral junction.



Fig. 4. Preoperative splayed rib showing the rim of the rib cage with the dent between the 9th and 10th ribs.

Case 4

A 36-year-old woman had fallen against the edge of a staircase at work. She was unable to return to work and attended the local pain clinic. No rib fractures had been diagnosed, and her chest radiographs and CT scan were normal. On examination, instability was palpated at the anterior rib cage between the seventh and eighth ribs.

During the surgical repair, overriding of the eighth rib cartilage was noted, with the tip of the cartilage piercing into the tissue. Part of the tip was removed, and the chondrochondral junction was stabilized (Fig. 3). The surgical repair resulted in improvement but only partial resolution of the chest wall pain. The patient, who was severely overweight, requested a breast reduction procedure in addition to the repair of her cartilage. She was advised to first lose weight and did not return.

Case 5

A 50-year-old man fell while painting his shed. He landed on his bicycle and hit his right rib cage. He presented to me again after several months of treatment in the pain clinic. Several intercostal spaces were tender and could be compressed more deeply than would be expected. This was associated with severe pain. He had difficulty sleeping, as he could not turn in his bed without agonizing discomfort.

He underwent sequential repair of 3 intercostal spaces and repair of an additional one 1 year later. After the last operation he stated that he could now turn at night without discomfort and had the best sleep in years (Fig. 2).

MAIN CHARACTERISTICS

These cases are rare, painful and difficult to diagnose. The characteristics are as follows:

- History of linear trauma to the chest wall (e.g., edge of barrel, edge of staircase) hitting the intercostal space and sometimes the chondrochondral junction.
- Local tenderness, decreased turgor of the tissue and mild instability of the ribcage, although radiographs and CT scans are normal.
- Often occurs at the chondrochondral junction.
- Pain persists for months or years.

Previously, similar discomfort was described in the upper abdomen or rib cage due to a rare configuration or movement of ribs.⁵⁻⁸ Excision of a painful

rolling rib or, in milder cases, treatment with local anesthesia was suggested.

INTRAOPERATIVE FINDINGS

We have to remember that the intercostal muscles are a miniature display of the lateral abdominal muscles: external oblique and internal oblique (both the same direction as the lateral abdominal muscles) (Fig. 5). The innermost intercostal muscle equivalent to the transverse abdominal muscle spreads its muscle fibres in a similar way to the internal oblique. The intercostal nerves travel on the top of the innermost intercostal and dive under the chondrochondral junction to continue their course in the more medial fields of the abdomen. It should be mentioned that the interchondral or chondrochondral junction and the intercartilagenous junction refer to the same structure: a firm ligament or the connective tissue between costal cartilages.

Trauma can stretch the inner or outer thoracic fascia, spread muscle and tear muscle from its attachment to the rib, but most often it can tear the intercartilagenous connections, which results in more instability.

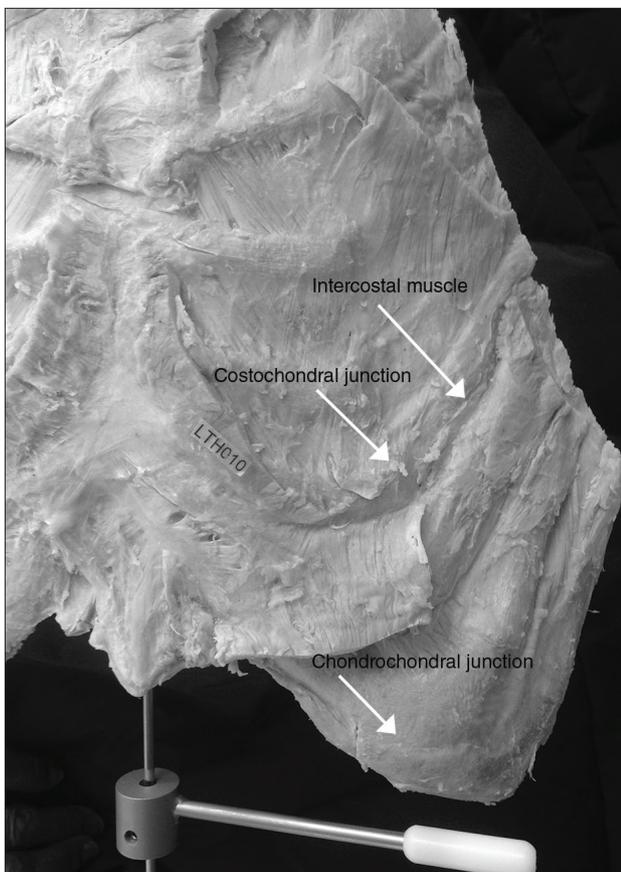


Fig. 5. Anterior chest wall showing costochondral junction and chondrochondral junction.

In several of these patients, the pain was localized at the cartilagenous junction. This was the area hit. The intercostal nerves travel underneath these firm connections and will be affected by the inflammatory events surrounding the injury. As cartilage has a certain elasticity, it does not easily tear; the structures around it take the insult. The external aponeurosis was seen to be stretched out in 1 case, and, in another instance, part of the internal oblique muscle was torn off the rib. At the same time it was noted that the semi-elastic interchondral ligament seemed overstretched.

If the connection felt unstable, strong 2-0 nonabsorbable nylon or Ti-Cron sutures on a cutting needle were passed through the cartilage, which was tied not too firmly to its neighbour. It is important not to make this repair too tight, as this would be just as uncomfortable as too loose (Figs. 1-3).

The cartilage can be penetrated by a cutting needle, but bony ribs cannot always. Yet a good bite into the periosteum of the bony rib was adequate to approximate torn muscle. These repairs could be seen in the same light as inguinal hernia repairs, in which the most medial stitch often gets anchored at the periosteum of the symphysis of the pubic bone. Sutures through an inadequately folded auricular cartilage are used in otoplasties in plastic surgery. Once the interchondral connection is stabilized with sutures through the cartilage, the rest of the tissue easily gets approximated without tension. Simple or mattress sutures reapproximate the muscles. (Remember the closure of an open appendectomy.) The internal and transverse oblique muscles get closed with simple or mattress sutures that are not too tight. It is necessary to repair the connection between cartilages first to get a stable frame.

There is no standard prescription for the operative repair. The repair needs to stabilize what seems to be loosened up (interchondral ligament).

DISCUSSION

When should this repair take place? It is useful to remember a similar condition, such as an ankle sprain. In the case of a complete ligament tear and instability, a referral to an orthopedic surgeon is indicated. The role of operative versus nonoperative treatment is still being debated.^{9,10}

MRI holds promise for the diagnosis and prognosis of disruption of syndesmosis of the ankle. One can only conclude that it would be quite a useful tool for the splayed rib as well.

The postoperative course could also be compared with that of a hernia repair. Limited motion, with the omission of strenuous activity, was recommended and seemed appropriate. Ligaments should be healed sufficiently by 6 weeks. Also, patients who have undergone hernia repair return to work after 6 weeks, provided a satisfactory follow-up visit takes place. This time frame would make sense for the splayed rib.

If the pain persists, further investigations seem justified if the disability is severe enough. When should the patient be referred? Narvani and colleagues¹¹ described a subgroup of patients with medial collateral ligament injury. Those with a persistently painful deep portion of the medial collateral ligament were eventually referred for surgery after initial conservative treatment. An average of 23 weeks had passed since the time of the injury to presentation to the specialist. After the surgical repair, at a mean of 48 weeks, all the patients returned to their sport and remained asymptomatic. The patient is referred early for surgical repair when a joint is unstable or severely painful, as in a knee ligament injury. A similar approach could be considered for the splayed rib. Possibly after 6 weeks, if no significant improvement has happened and if the functionality of everyday life is disturbed, a surgical option appears logical.

Why is this condition not better known or reported? The primary reason is that it is rare. Most blunt injuries heal over time. There may be quite a spectrum of severity of cases. Often, the absence of findings on radiographs or CT scans leads to the conclusion that nothing else needs to be done apart from prescribing painkillers. If this fails, physiotherapy helps restore the connective tissue. Finally, the degree of injury of knee ligaments can be shown with stress views; however, this would be difficult to achieve with rib splay. MRI is reserved for the most severe ligament injuries. Three grades have been distinguished on MRI, but often this grading system does not go hand in hand with the clinical severity.²

It might be difficult to arrange for a prospective study comparing surgical repair of the splayed rib to conservative surgical treatment considering that the condition is rare. I performed the repairs several

months after the patients were followed in medical clinics, pain clinics, or in 1 case, by a physiatrist, who made the referral. Although the number of cases is small, there was complete resolution in 4 cases and partial resolution in 1. This might serve as a stimulus for surgical repair in another institution. The internal thoracic fascia was never transected; therefore, no pneumothorax ensued.

This repair has not been reported in the literature. It is not too difficult for a motivated surgeon familiar with the anatomy to perform and could easily be done in a small peripheral hospital.

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