

Peer Review File

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Reviewer A

Comment 1: The English needs to be edited.

Some edits:

Line 79 – The pain is described like should be replaced with “as”

Line 110 – anamensis should be “history” – this word should be replaced throughout the document

Line 116 – All operations were conducted in should be replaced with “under”

Line 149 – ark should be replaced with “arch”

Line 154 – 15-129 – I think should be 15-21

Line 157 – As a consequence, relevant – should be replaced by “significant”-

Line 160 – 7 to 10 - should be 7th to 10th

Line 165 – periost should be periosteum

Line 167 – with unhurt should be “without previous trauma”

Line 171 –certain movements that could be performed trouble free should read certain movements “that did not cause pain”

Lines 181- 183 – I think just needs to be rewritten. I’m not entirely sure what you are trying to say here. Maybe try to divide it into 2 sentences?

Line 193 – bring out should read “aid”; also insert “naming these” between We suggest a and congenital primary. Also take out the word appearance.

Reply 1: We thank the reviewer for his polite reference to language weaknesses in our manuscript. We have therefore had our work revised by a native speaker. We have also corrected the linguistic errors in the text pointed out by the reviewer.

Changes in text: We have corrected the linguistic errors in the text pointed out by the reviewer. The native speaker made additional changes.

Comment 2: In the conclusion in the abstract, was the rib and cartilage excised in every patient? How was the amount of rib excised decided? Was it consistent with everyone? 1 cm? 2 cm?

Reply 2: Our surgical technique aimed at preventing the two ends of the rib from touching. Therefore, a sufficiently long section of the rib was resected intraoperatively to ensure a finger-width distance between the ribs (please see ll. 169 ff). Based on the existing rib

morphology, rib pieces of different lengths had to be removed from the different patients (approx. 2-4 cm).

Changes in the text: We specified our surgical technique by adding: “Based on the existing rib morphology, rib pieces of different lengths had to be removed from different patients (approx. 2-4 cm).” (ll. 169-171).

Comment 3: Regarding the diagnosis, hooking maneuver should produce rib movement and pain. The maneuver would hurt most people even without CS.

Reply 3: The hooking maneuver is a sensitive manual examination technique. We agree with the reviewer that a crude deflection of the lower ribs should cause pain in every individual. According to our clinical experience, however, patients with pathological rib mobility or pathological axis deviations of the ribs can be clinically identified with an experienced manual examination technique. We specified our method section accordingly.

Changes in the text: We specified our diagnostic work-up by adding:” The examiner hooks the fingers under the inferior margin of the ribs at the affected side and then carefully deflects them cranially. For a meaningful examination technique, the examiner has to work with a little force in order to be able to detect pathological changes in the chest wall and to avoid false positive findings.” (ll.157 ff).

Comment 4: In table 2, the intraoperative finding is a fracture of C11 (I think Fraktur is the same as fracture?) in patient 8. I’m not sure how that meets the definition of CS and goes against excluding those patients with current injury. Perhaps this patient should be excluded?

Reply 4: To address the reviewer’s comment, we have defined “osteo-cartilaginous pain syndrome” as a more comprehensive term for the chest wall pain syndromes that we have addressed in our patients.

Changes in the text: (ll. 105 ff): In the scientific literature, various pathological changes in the bony and cartilaginous sections of the ribs have been described which can lead to pain in the chest wall that can be triggered mechanically (Tab. 1). Unfortunately, these rare osteo-cartilaginous pain syndromes (OCPS) are still little known; even among thoracic surgeons: Often, the pain complained by the patients cannot be clearly assigned to one of these pain syndromes.

Comment 5: Was their rib fracture on the same side as the current symptom or on the same rib? Was the fracture more lateral or posterior? How does a fracture contribute to an overlong rib C11? (the descriptor for 3 of the trauma patients and all but 2 of the other patients)

Reply 5: We regret that we misled the reviewers by incorrectly grouping several clinical syndromes under the term Cyriax Syndrome.

Changes in the text: We corrected this error when revising this manuscript and expanded the clinical information on our patients in Table 2.

Comment 6: You assert that primary CS emerges in younger patients due to malformations becoming apparent in chest wall remodeling in adolescence. I do not understand this assertion. Please state evidence or clarify your statement.

Reply 6: Our clinical experience leads us to the conclusion that patients with primary SRS have pathological mobility of individual ribs. There is no malformation of the thoracic wall in these patients. We do not want to claim this either. We have therefore reworded our statement accordingly.

Changes in the text: We reworded our discussion (ll. 215 ff): “The pathogenesis of some OCPS is well understood: In CS it is the lack of cartilaginous or fibrous attachments of the ribs 7th to 10th building the costal arch. This impaired connection results in a non-physiological mobility of the ribs eventually culminating in an anterior or posterior subluxation following certain movements including deep breathing, sneezing, coughing and sitting.”

Furthermore, we have added the pathogenesis for 12th rib syndrome and iliocostal impingement syndrome described in the current literature, to emphasize differences regarding the syndrome summarized as OCPS.

Changes in the text: The descriptions have been added (ll. 223 ff): “The 12th rib syndrome is the result of a hypermobility of the affected rib due to its lack of any bony attachments. The pain is then caused by irritation of the adjacent intercostal nerve. Similarly, a hypermobile 11th rib may cause comparable pain. In our experience, hypermobility of both floating ribs results in the same clinical symptoms and should be treated alike. Evidence regarding 12th rib syndrome is scarce. The existing literature suggest that analogous to CS, 12th rib syndrome may be treated by partial rib resection, leading to long-lasting pain relief [6].

Iliocostal impingement syndrome on the other hand is associated with thoracic hyperkyphosis and kyphoscoliosis [7]. In another case, all patients had noticed a significant loss of height and the symptoms were associated with osteoporosis [8]. Contact between the lowest rib and the iliac crest seems to be the cause of the pain [7, 8]. Literature regarding the treatment of iliocostal impingement is even further limited, but partial resections for these patients has shown to offer relief of symptoms. [8]. A different and interesting approach focused on treatment of the underlying hyperkyphosis and kyphoscoliosis by a weighted kypho-orthosis and a back strengthening program, has also led to successful pain management [7].”

Reviewer B

Comment 1: Rib tip syndrome and 12th rib syndrome are separate entities from Cyriax Syndrome/Slipping Rib Syndrome. Slipping rib syndrome only involves the false (8-10th) ribs. Rib tip syndrome refers to costoiliac impingement of the 11th or 12th rib tips. 12th rib syndrome refers to upward deviation of the 12th rib with compression of the 11th intercostal nerve. These are not synonyms and this line should be revised.

Reply 1: We would like to thank the reviewer for clearly naming an existing weakness in our work. We assume that the differentiation between the different chest wall pain syndromes will also be difficult for many readers of this article. To address the reviewers comment we have defined “osteocartilaginous pain syndrome” as a more comprehensive term for the chest wall pain syndromes that we have addressed in our patients. In addition, we have included a table with the established chest wall pain syndromes in the introduction of our article. In 1975, McBeath and Keene presented three cases of slipping rib syndrome, calling them “Rip-Tip syndrome”. In table 1. we have indicated Rib-Tip syndrome to be identical with Slipping rib syndrome.

Changes in the text: (ll. 105 ff): In the scientific literature, various pathological changes in the bony and cartilaginous sections of the ribs have been described which can lead to pain in the chest wall that can be triggered mechanically (Tab. 1). Unfortunately, these rare osteocartilaginous pain syndromes (OCPS) are still little known, even among thoracic surgeons, and often the pain complained by the patients cannot be clearly assigned to one of these pain syndromes.

The original reference for “Rib-tip syndrome” has been added (l. 312): 2. McBeath AA, Keene JS. The rib-tip syndrome. *J Bone Joint Surg Am.* 1975 Sep;57(6):795-7.

Comment 2: These conservative measures do not lead to lasting pain relief. This statement should be revised to state they are temporary in their pain relief.

Reply 2: We thank the reviewer for stressing this point. We changed our text accordingly.

Changes in the text: (ll. 129 f). Therapeutic intercostal blocks with glucocorticoids, local anesthetics, or Botulinum toxin have a high chance to achieve temporary pain reduction, but not lasting pain relief.

Comment 3: Costal cartilage excision has been shown to resolve symptoms in some patients but has a reported failure rate of 25-50%.

Reply 3: We thank the reviewer for pointing out the limitations of CCE. We have therefore included this information in our presentation.

Changes in the text: (ll. 132 f). However, in larger studies, a failure rate exceeding 25% has been reported and additional surgical measures including rib stabilization have been suggested.

Comment 4: Which ribs underwent CCE in your patients? Were they all false ribs? How many ribs per patient were treated? Were any excisions performed in the floating ribs (11-12)? If so, they should not be included in this series that describes Cyriax Syndrome.

Reply 4: We have specified the description of our surgical technique in the methods section.

Changes in the text: (ll. 169 ff): In every case, only one rib was operated on. Based on the existing rib morphology, rib pieces of different lengths had to be removed from patients (approx. 2-4 cm).

Comment 5: A lack of cartilaginous or fibrous attachments to the false ribs (11-12) is not pathologic. This is normal anatomy and inclusion of 11 and 12 into reports of the pathogenesis of slipped rib syndrome/Cyriax Syndrome adds to the confusion about this disorder.

Reply 5: We thank the reviewer for this clarification. We have revised our text accordingly in terms of a correct scientific presentation.

Changes in the text: (ll. 215 ff) The pathogenesis of some OCPS is well understood: In CS, it is the lack of cartilaginous or fibrous attachments of the ribs 7th to 10th building the costal arch.

Comment 6: Many typographical errors appear in this paper.

Reply 6: We corrected the indicated errors.

Changes in the text: (l. 204) arch, (l. 219) Breathing, (l. 222) periosteum.

Comment 7: CCE has been shown to be an effective and reliable treatment guaranteeing sustained pain relief.” This is highly overstated and cannot be claimed with a 25-50% recurrence rate published in the largest series in the literature. At best, a statement can be made that claims durable pain relief in some patients. This should be restated in the paper.

Reply 7: The reviewer correctly points out that in larger studies, CCE has not led to freedom from pain in a relevant proportion of patients. We have therefore weakened our presentation of the effectiveness of CCE in the discussion accordingly. Nevertheless, CCE shows high effectiveness in our study.

Changes in the text: (ll. 260 ff) Patients benefitted from CCE and experienced sustained freedom from pain, although recent studies indicate that a relevant proportion of these patients retain pain in the long run and may benefit further from vertical plating in addition to CCE [19].]

Comment 8: This series of 11 patients should be revised to include only slipped rib syndrome patients (ribs 8-10). Any with 11th or 12th rib excisions should be omitted as they cannot be classified as slipped rib syndrome at all. The series may be, therefore, even smaller than 11 patients.

Reply 8: The reviewer knowledgeably pointed out that the patient cohort presented by us does not consist solely from CS patients, but rather includes several disease entities. Therefore, as part of the revision of our contribution, we have combined the entities addressed under the term osteo-cartilaginous pain syndrome. Our clinical experience with patients who

have had to consult doctors from a wide range of disciplines for several years because of a chest wall pain syndrome before a diagnosis is made, once again proves that these pain syndromes are still little known in the medical community and that the publication of our experiences will contribute knowledge.

Changes in the text: (ll. 105 ff) In the scientific literature, various pathological changes in the bony and cartilaginous sections of the ribs have been described which can lead to pain in the chest wall that can be triggered mechanically (Tab. 1). Unfortunately, these rare osteo-cartilaginous pain syndromes (OCPS) are still little known, even among thoracic surgeons, and often the pain complained by the patients cannot be clearly assigned to one of these pain syndromes.

Reviewer C

Comment 1: Minor revision. (1-4)

Reply 1: We thank the reviewer for the appreciative evaluation of our analysis and thank you for the helpful hints on linguistic errors in our manuscript. We have made the suggested changes to the text.

Changes in the text: We have made the suggested changes to the text.