

Spontaneous sternal fracture during labor in a healthy primigravida with female athlete triad: A case report

Alexandra B. Aserlind^{a,*}, Cathy A. Burnweit^b

^a Department of Obstetrics and Gynecology, University of Miami Miller School of Medicine, USA

^b Department of Pediatric Surgery, Nicklaus Children's Hospital, Miami, Florida, USA

ARTICLE INFO

Article history:

Received 10 April 2020

Received in revised form 25 April 2020

Accepted 28 April 2020

Keywords:

Sternal fracture

Labor

Female athlete triad

ABSTRACT

Introduction: This case raises awareness of the diagnosis of sternal fracture during labor and obviates the need for lengthy, expense-consuming workup. This report identifies a subset of women who may be at higher risk for this pathology.

Methods: Upon diagnosing and treating a patient who spontaneously fractured her sternum during labor, we reviewed previously reported cases and highlight key points of this entity.

Results: We report the third case of sternal fracture during labor in a healthy primigravida with female athlete triad. After 12 h of labor, the woman underwent epidural placement. By 16 h, the cervix was fully dilated. During the second push in the chin-to-chest position, a healthy baby was delivered, but the mother experienced acute anterior chest pain. Tenderness persisted for three weeks. Plain radiographs confirmed the presence of the fracture, which healed spontaneously.

Conclusion: While chest pain during labor often results from serious causes including pulmonary embolism, myocardial infarction, and spontaneous pneumothorax, hyperflexion sternal fracture can occur, particularly in a woman with female athlete triad.

© 2020 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Chest pain during or immediately after parturition usually stems from self-limiting processes such as muscle strain, costochondritis or gastroesophageal reflux. The onset of severe pain, however, can be a harbinger of serious illness such as heart attack [1], spontaneous pneumothorax or pneumomediastinum [2,3], pulmonary embolism [4], aortic dissection [5], or pneumonia [6]. While we report only the third case of sternal fracture during labor. This case raises awareness of the diagnosis and illustrates the signs and symptoms which allow identification of this rare entity, obviating the need for lengthy, expense-consuming workup at a time critical to the developing maternal-infant relationship. It also identifies a subset of women, those with female athlete triad [7] (Table 1), who may be at higher risk for this pathology.

2. Case presentation

2.1. Patient information

A healthy 29-year-old primigravida went into spontaneous labor at 39 weeks and 1 day of gestation. She had a medical history of celiac

disease and six years of amenorrhea, suspected to be hypothalamic in origin due to collegiate athletics and subsequent marathon training, with resumption of menstruation 4 months prior to conception. She reported leg stress fractures within the last year, but no personal or family history of pathologic fractures or bone disease. There was no history of eating disorder. While her body mass index had been as low as 16.5 kg/m² 18 months prior, it was 19.5 at conception.

The woman initiated prenatal care at 6 weeks of gestation. She continued to exercise until she reached term – running and walking two to three times weekly – and gained 25 pounds during the pregnancy. The patient took prenatal vitamins until 32 weeks, after which she self-discontinued secondary to constipation. The pregnancy was uncomplicated; routine laboratory testing was normal except for the 50 g, 1-h oral glucose tolerance test (OGTT), which revealed elevated glucose levels. The subsequent 100 g, 3-h OGTT yielded 4 normal values. All fetal surveys were unremarkable.

With the onset of labor, the patient remained at home for 8 h before presenting to the hospital. Epidural anesthesia was initiated, and artificial rupture of membranes was performed at 3 cm dilatation, after 11 h of labor. She was not augmented with oxytocin. She dilated to 10 cm at 16 h, after which she assumed the dorsal lithotomy position for delivery. The baby was at 0 station and with one push descended to +2. During the next contraction, the patient instigated another push, trunk curled forward in a chin-to-chest position whilst holding the posterior aspect of her thighs, delivering a viable 2.8-kg infant without complication.

* Corresponding author at: UMMSM Department of Obstetrics and Gynecology, 1611 NW 12th Ave, Miami, Florida 33136, USA.

E-mail address: Alexandra.aserlind@jhsMiami.org (A.B. Aserlind).

Table 1

Components of Female Athlete Triad as defined by the American College of Obstetricians and Gynecologists [6].

- | |
|---------------------------------|
| 1) Low energy ± eating disorder |
| 2) Menstrual abnormalities |
| 3) Low bone density |

No one assisted the patient in the flexion of her torso during the expulsion efforts. She later reported that she experienced severe, acute-onset chest pain at the time of the second Valsalva.

While the patient and infant were skin-to-skin immediately after birth, the mother complained of sternal discomfort where the child's head lay on her chest and also from the dependent pressure of her breasts while nursing the baby. The mother had point tenderness at the manubrium-sternal junction. She reported this to the on-call obstetrician on the first postpartum day. There was no concern for pulmonary embolism or any life-threatening processes, as vital signs and functional status were unaffected. She received acetaminophen and ibuprofen during her 36-h stay in the hospital, which she continued around the clock for the next few weeks. During the postpartum period, the patient needed assistance to turn over in bed, had difficulty picking up the baby and experienced chest pain with breastfeeding, eating, driving, inspiration and coughing. These symptoms, accompanied by tenderness to palpation over the sternum, lasted for 3 weeks unabated.

2.2. Diagnostic assessment

Evaluation with a chest X-ray revealed an acute sternal fracture with mild displacement (Fig. 1). She was referred to a cardiothoracic surgeon who recommended conservative management. As there was suspicion of the female athlete triad, a metabolic workup was undertaken. Calcium and vitamin D levels were normal. Bone density scans revealed lumbar T-score of -1.8 and Z-score of -1.6 .

2.3. Treatment and follow-up

She was treated conservatively with lifestyle modification, activity restriction, non-opioid medications and calcium supplementation. Five

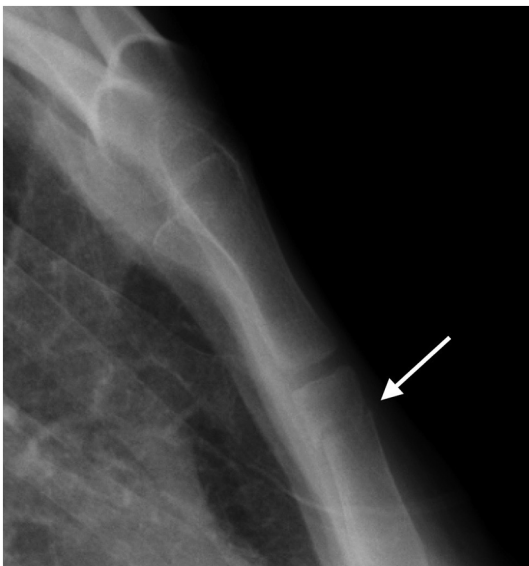


Fig. 1. Lateral Sternal Radiograph 3 Weeks Postpartum. The arrow depicts fracture. Lateral Sternal Radiograph

weeks post-partum, the patient described improvement in her symptoms and by 9 weeks was pain-free and off analgesics.

3. Discussion

Two previous cases of spontaneous sternal fracture during labor have been reported [8,9]. While the broad generalizations are limited for an entity so rarely recognized, the three patients share multiple aspects: all women were young, healthy primiparas at term, pushing during the expulsion phase of labor in the chin-to-chest position. Each could pinpoint the exact onset of pain and cited exquisite sternal point tenderness as the principal symptom but gave little attention to the problem in the excitement after birth. In the first case, the mother's partner supported her neck, and others present heard a snapping sound; neither of these occurred in our case. While the first two patients' anthropomorphic data are unknown, our patient met criteria for the female athlete triad. In young women, bone density Z-scores of greater than -2 are considered normal, but for female athletes, whose weight-bearing activities should lead to higher than normal bone mineral density (BMD), the American College of Sports Medicine defines low BMD or osteopenia as Z-scores between -1 and -2 , the range into which our patient fell [10].

Sternal fracture most frequently stems from blunt trauma, with automobile collisions the principal etiology [11–13]. Other mechanisms involving direct forces include falls, sporting injuries, CPR, and assault. Fractures resulting from indirect forces include pathologic sternal fractures (e.g., from malignancy), insufficiency fractures (e.g., from osteoporosis), and stress fractures caused by severe hyperflexion [13]. All reported etiologies in this last category—weightlifting [14], gymnastics [15], golf [16] and now during labor—have a unified injury mechanism: the patient curls forward, causing severe flexion of the sternum, which buckles. Chest pain is the salient symptom. Of cases of spontaneous hyperflexion fracture, the only ones reported in females occurred in gymnasts, a large proportion of whom demonstrate components of female athlete triad [17]. Sternal fractures heal spontaneously, and most need no specific orthopedic treatment.

Chest pain during labor has an extensive differential diagnosis. Muscle strain, acid reflux and costochondritis are common. Life-threatening causes of chest pain are rare but well recognized. Pulmonary embolism, caused by hypercoagulability, venous stasis and vascular injury, is the most common cause of direct maternal mortality in developed countries [5]. Myocardial infarctions during pregnancy and puerperium, a quarter of which occur during labor [2], have increased in the last two decades. Other etiologies include spontaneous pneumothorax, pneumomediastinum, aortic dissection in pregnant women [3–5] and acute pulmonary edema, from hypertension in preeclampsia, cardiogenic issues or fluid overload [18].

Pain from sternal fracture must be distinguished from these more serious etiologies. All three cases of sternal fracture during parturition presented with three conditions: (a) clear-cut, sudden chest pain while (b) maintaining the chin-to-chest position accompanied by (c) tenderness to palpation with functional limitations (a sign not seen in any of the serious medical causes of chest pain). Identifying these features would have strongly suggested the clinical diagnosis. Time-consuming workups with disruption of the maternal-infant dyad, added expense and the risks of testing and unnecessary anxiety can be avoided. Confirmation requires a radiograph, which was performed in all three cases. As for most patients with sternal fracture regardless of etiology, the three women were treated with reassurance and analgesics, and fractures healed within weeks.

Our case suggests a relationship between female athlete triad and sternal fracture during labor. Screening female athletes, using menstrual and activity history, is straightforward and recommended by a 2017 American College of Obstetricians and Gynecologists Committee Opinion [6]. Not all components of the syndrome must be present for the diagnosis to be made. Patients with clinical manifestations of the entity

may benefit from specific vitamin supplementation during and after pregnancy, along with bone density surveillance. Additionally, moderation of sudden, forceful thoracic flexion during parturition is advisable.

In summary, spontaneous sternal fracture is a rare complication of labor and must be distinguished from more serious conditions. Awareness of the entity and recognition of the appropriate scenario — acute onset of pain accompanied by sternal point tenderness in the setting of torso hyperflexion — allows diagnosis by chest X-ray. The presence of female athlete triad may put women at risk for this complication, and screening should be incorporated into the prenatal visits.

Contributors

Each author contributed to design, data collection, research and writing. Both authors approved the final article.

Conflict of interest

The authors declare that they have no conflict of interest regarding the publication of this case report.

Funding

No funding from an external source supported the publication of this case report.

Patient consent

The patient read the manuscript and given written permission for its publication.

Provenance and peer review

This case report was peer reviewed.

References

- [1] N.R. Smilowitz, N. Gupta, Y. Guo, et al., Acute myocardial infarction during pregnancy and in the puerperium in the United States, *Mayo Clin. Proc.* 93 (10) (2018) 1404–1414.
- [2] R. Garq, Sanjay, V. Das, K. Usman, S. Rungta, R. Prasad, Spontaneous pneumothorax: an unusual complication of pregnancy - a case report and review of literature, *Ann. Thorac. Med.* 3 (3) (2008) 104–105.
- [3] S. Pinto, B.S. Mahankali, M.M. Prasanna, Spontaneous pneumothorax in pregnancy: a challenge for anaesthesiologist, *J. Obstet Anaesth Crit. Care.* 7 (2) (2017) 106–108.
- [4] L. Simcox, L. Ormesher, C. Tower, I. Greer, Pulmonary thrombo-embolism in pregnancy: diagnosis and management, *Breathe* 11 (2015) 282–289.65.
- [5] H. Kamel, M. Roman, A. Pitcher, R. Deverwux, Pregnancy and the risk of aortic dissection or rupture: a cohort-crossover analysis, *Circulation.* 134 (2016) 527–533.
- [6] Committee Opinion No. 702, American College of obstetricians and gynecologists: female athlete triad, *Obstet. Gynecol.* 129 (2017) e160–e167.
- [7] C. Graves, Pneumonia in pregnancy, *Clin. Obstet. Gyn.* 53 (2) (2010) 329–336.
- [8] J. Stubert, B. Gerber, Fracture of maternal sternum during spontaneous delivery, *Arch. Gynecol. Obstet.* 280 (2009) 1007–1009.
- [9] D. Edwards, N. Ward, Sternal fracture as a complication of normal vaginal delivery labour, *Injury Extra.* 38 (2007) 239–240.
- [10] T.G. Nazem, K.E. Ackerman, The female athlete triad, *Sports Health.* 4 (4) (2012) 302–311.
- [11] T. von Garrel, A. Ince, A. Junge, J.A. Schnabel, C. Bahrs, The sternal fracture: radiographic analysis of 200 fractures with special reference to concomitant injuries, *J. Trauma* 57 (4) (2004) 837–844.
- [12] G. Recinos, K. Inaba, J. DuBose, G. Barmparas, P.G.R. Teixeira, P. Talving, D. Plurad, D. Green, D. Demetriades, Epidemiology of sternal fractures, *Am. Surg.* 75 (5) (2009) 401–404.
- [13] A. Khoriaty, R. Raiakulasingam, R. Shah, Sternal fractures and their management, *J. Emerg Trauma Shock.* 6 (2) (2013) 113–116.
- [14] K. Robertsen, O. Kristensen, L. Vejen, Manubrium sterni stress fracture: an unusual complication of non-contact sport, *Br. J. Sports Med.* 30 (2) (1996) 176–177.
- [15] I. Hassan, D.A. Ramagole, D.C. van Rensburg, C.C. Grant, R. Collins, Sternal stress fracture in a gymnast: a case report and literature review, *S. Afric. J. Sports Med.* 22 (2) (2010) 50–51.
- [16] D.L. Alexander, Golf-related stress fractures: a structured review of the literature, *J. Can. Chiropr. Assoc.* 53 (4) (2009) 290–299.
- [17] T. Siatras, D. Mameletzi, The female athlete triad in gymnastics, *Sci. Gymnast. J.* 6 (1) (2013) 5–22.
- [18] A.C. Pordeus, L. Katz, M.C. Soares, S.B. Maia, M.M. Amorim, Acute pulmonary edema in an obstetric intensive care unit: a case series study, *Medicine (Baltimore)* 97 (28) (2018), e11508.