

## **Pectus carinatum repair in an adolescent with hyperhomocysteinaemia: Anaesthetic implications**

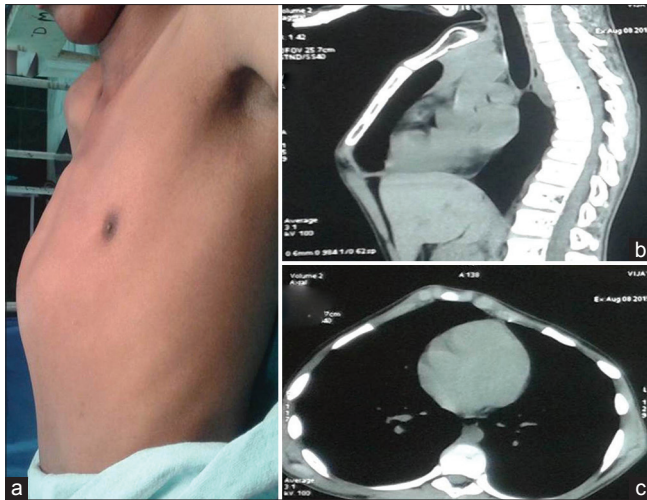
Sir,

Pectus carinatum is a chest wall deformity that occurs less frequently and surgical correction for this chest wall deformity is mostly for cosmetic reasons. Anaesthesia for this procedure may be complicated by associated systemic disorders such as Marfan's disease, homocystinuria, Prune belly syndrome, Morquio syndrome, osteogenesis imperfecta, Noonan syndrome, mitral valve prolapse, scoliosis or other collagen vascular diseases.<sup>[1]</sup> Although the surgical aspects of pectus carinatum repair are extensively reported, literature on anaesthetic management is sparse. We report the successful management of a case of pectus carinatum repair in an adolescent patient with hyperhomocysteinaemia and kyphoscoliosis.

A 14-year-old boy weighing 40 kg presented to the hospital with complaints of protuberance of the lower chest since birth which had significantly increased in

the last 2 years. Computed tomography of the chest revealed chondrogladiolar type of pectus carinatum with Haller index of 1.6 (Haller's index, the ratio of transverse diameter of thorax to antero-posterior diameter at lower third of sternum, normal value = 2.5) and thoracic kyphoscoliosis to left [Figure 1]. Pulmonary function testing showed moderate restrictive pattern. A year earlier, he had suffered from the left upper motor neurone Bell's palsy, which was self-limiting. Evaluation for early onset of cerebrovascular disease revealed homocysteinaemia with homocysteine levels of 18.5  $\mu\text{mol/l}$ . He was treated with folic acid, Vitamin B6 and B12 supplements. The patient now desired to have a repair of pectus carinatum which was scheduled under general anaesthesia. Pre-operatively, vitamin supplements were continued.

In the operation theatre, intravenous (iv) line was inserted and American Society of Anesthesiologists standard monitoring was connected. An epidural catheter was placed in T7–8 space for intra and postoperative analgesia. Epidural analgesia was initiated with a bolus of 7 ml of 0.25% bupivacaine followed by an infusion of 0.125% bupivacaine at 8 ml/h. Elastic stocking was used in the legs to avoid venous stasis. The patient was pre-medicated with fentanyl 100  $\mu\text{g}$ , midazolam 1 mg, induced with thiopentone 200 mg and tracheal intubation was

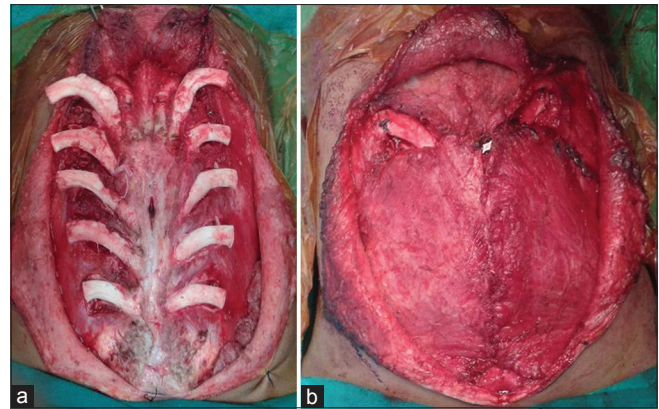


**Figure 1:** (a) Image of the patient chest showing pectus carinatum. (b and c) computed tomography scan chest of the patient (sagittal and transverse sections, respectively) showing pectus carinatum

facilitated with rocuronium 1 mg/kg. The patient was intubated with a 7-mm-cuffed endotracheal tube and ventilated in volume control mode with a tidal volume of 300 ml. The respiratory rate was adjusted to EtCO<sub>2</sub> of 35–38 mm Hg. Anaesthesia was maintained on oxygen in 50% air, sevoflurane and infusion of atracurium. Bilateral pectoralis major flaps were raised and outgrown portions of third to seventh costal cartilages were resected [Figure 2]. Costochondral junctions were fixed with miniplates and screws. Finally, it was covered with the pectoralis major flaps [Figure 2]. The total surgical duration was 7 h. Continuous temperature monitoring and random blood sugar monitoring were done. Forced air warming was used to maintain normothermia. In view of extensive dissection of thoracic wall, the patient was electively ventilated post-operatively and extubated after 6 h. In the post-operative period, adequate analgesia and early mobilisation were stressed upon to reduce the risk of deep vein thrombosis (DVT).

Pectus carinatum is chest wall deformity characterised by anterior protrusion of sternum due to overgrowth of costal cartilage and mainly affects males.<sup>[1,2]</sup> During growth spurt of puberty, the condition becomes more obvious and consequently, changes in behaviour and personality may frequently occur. Pectus carinatum may be associated with Marfan's disease, homocysteinuria, Prune belly syndrome, Morquio syndrome, osteogenesis imperfecta, Noonan syndrome and mitral valve prolapse.<sup>[1]</sup>

The most common treatment is use of sternal braces. Surgery may be opted in patients not responding to



**Figure 2:** Intra-operative images showing repair of pectus carinatum. (a) The exposed costochondral joints of 3–7<sup>th</sup> ribs. (b) Bilateral pectoralis major flaps covering the repaired costochondral joints

braces, older children with hard sternum, in patients with pain or for cosmesis. Surgical repair of pectus carinatum has also shown to improve mental health and quality of life.<sup>[3,4]</sup> The surgical procedure involves resection of overgrown costal cartilages, osteotomy of sternum and fixation with metal plate and screws. In our patient, additional pectoralis major flap was taken to cover the implants and thus avoid infection.

Hyperhomocysteinaemia is a genetic disease leading to accumulation of homocysteine causing multisystem manifestations. Normal levels are within 7–10  $\mu\text{mol/l}$ . Levels between 15 and 30  $\mu\text{mol/l}$  are considered mild to moderate.<sup>[5]</sup> Homocysteinaemia causes oxidative vascular endothelial damage and creates procoagulant state by activating platelet aggregation and adhesion.<sup>[6]</sup> Thus, it can increase the risk of DVT in prolonged surgeries. Hence, we used elastic stockings in the intra-operative period. In patients with homocysteinaemia, increased levels of methionine leading to increased insulin release can cause hypoglycaemia. Thus, we monitored random blood sugar levels intra-operatively. Nitrous oxide was avoided as it may increase homocysteine levels by inhibiting methionine synthase.<sup>[7]</sup>

Pulmonary function restriction in our case could be partly due to pectus and partly due to kyphoscoliosis. Surgery does not improve pulmonary function in pectus carinatum unlike pectus excavatum.<sup>[8]</sup> Thus, pre-existing restrictive ventilatory function may be further compromised by pain and optimising post-operative analgesia is the major concern in these surgeries. Continuous epidural infusion is most commonly used for providing analgesia in pectus correction surgeries, but patient controlled iv analgesia has been found to be equally effective.<sup>[9,10]</sup> We could

place the epidural catheter without much difficulty because of less severe spine deformity in our patient and achieved satisfactory analgesia.

The associated comorbidities, pain and respiratory dysfunction may complicate the benign cosmetic procedures for pectus carinatum. Attention to DVT prevention, adequate analgesia and early ambulation aid in successful management in these patients.

#### Financial support and sponsorship

Nil.

#### Conflicts of interest

There are no conflicts of interest.

**Prachi Kar, Suresh Kumar Chintha, Padmaja Durga,  
Ramachandran Gopinath**

Department of Anaesthesia and Intensive Care, Nizams Institute of Medical Sciences, Hyderabad, Telangana, India

#### Address for correspondence:

Dr. Prachi Kar,

Department of Anaesthesia and Intensive Care, Nizams Institute of Medical Sciences, Hyderabad - 500 082, Telangana, India.

E-mail: prachikar@yahoo.co.in

#### REFERENCES

1. Robicsek F, Watts LT. Pectus carinatum. *Thorac Surg Clin* 2010;20:563-74.
2. Shamberger RC, Welch KJ. Surgical correction of pectus carinatum. *J Pediatr Surg* 1987;22:48-53.
3. Bostanci K, Ozalper MH, Eldem B, Ozyurtkan MO, Issaka A, Ermerak NO, *et al.* Quality of life of patients who have undergone the minimally invasive repair of pectus carinatum. *Eur J Cardiothorac Surg* 2013;43:122-6.
4. Knudsen MV, Grosen K, Pilegaard HK, Laustsen S. Surgical correction of pectus carinatum improves perceived body image, mental health and self-esteem. *J Pediatr Surg* 2015;50:1472-6.
5. Graham IM, Daly LE, Refsum HM, Robinson K, Brattström LE, Ueland PM, *et al.* Plasma homocysteine as a risk factor for vascular disease. The European concerted action project. *JAMA* 1997;277:1775-81.
6. Harpel PC, Zhang X, Borth W. Homocysteine and hemostasis: Pathogenic mechanisms predisposing to thrombosis. *J Nutr* 1996;126 4 Suppl: 1285S-9S.
7. Myles PS, Chan MT, Kaye DM, McIlroy DR, Lau CW, Symons JA, *et al.* Effect of nitrous oxide anesthesia on plasma homocysteine and endothelial function. *Anesthesiology* 2008;109:657-63.
8. Cahill JL, Lees GM, Robertson HT. A summary of preoperative and postoperative cardiorespiratory performance in patients undergoing pectus excavatum and carinatum repair. *J Pediatr Surg* 1984;19:430-3.
9. Muhly WT, Maxwell LG, Cravero JP. Pain management following the Nuss procedure: A survey of practice and review. *Acta Anaesthesiol Scand* 2014;58:1134-9.
10. Stroud AM, Tulanont DD, Coates TE, Goodney PP, Croitoru DP. Epidural analgesia versus intravenous patient-controlled analgesia following minimally invasive pectus excavatum repair: A systematic review and meta-analysis. *J Pediatr Surg* 2014;49:798-806.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

Access this article online	
Quick response code	Website: www.ijaweb.org
	DOI: 10.4103/0019-5049.193711

**How to cite this article:** Kar P, Chintha SK, Durga P, Gopinath R. Pectus carinatum repair in an adolescent with hyperhomocysteinaemia: Anaesthetic implications. *Indian J Anaesth* 2016;60:873-5.