

Parietal Wall Hernia: A Rare and Avoidable Complication in Anterolateral Mini Thoracotomy Retroperitoneal Approach for Dorsolumbar Fractures

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Abstract: ***Aims & Objective:** To evaluate the incidence of parietal wall hernia and its pathophysiology in cases of traumatic dorsolumbar fractures operated via anterolateral mini thoracotomy retropleural & retroperitoneal approach. **Material and Methods:** A retrospective analytical study of patients of traumatic dorsolumbar fractures was carried out in our institute from Jan 2015 to June 2018. A total of 50 patients (n = 50) out of 130 were managed by this retropleural / retroperitoneal mini thoracotomy approach. There were 40 males and 10 females (M:F= 4:1). Out of these, 34 patients underwent single rib resection depending upon the level of fractured vertebra and 16 patients underwent excision of 11th & 12th ribs. This was followed by diaphragmatic sparing retroperitoneal approach for performing corpectomy, placement of expandable cage and fixation with screw and rod. The mean follow up of the patients was 18 months (range 6 - 30 months). Thickness of the abdominal wall muscle was measured by follow-up computed tomography (CT) scan. Compound muscle action potentials (CMAPs) of the abdominal muscle were examined in these three patients. **Results:** 3 out of the 50 (6%) patients developed parietal wall hernia. However, none of these patients showed features of obstruction. The thickness of the abdominal wall muscle was reduced at the operated site as measured on CT vis a vis the normal side. CMAP of abdominal rectus muscle was low/non recordable in comparison to the contralateral side. **Conclusions:** All these 3 patients of parietal hernia had undergone resection of two ribs (11th & 12th) and were the initial cases of this study. Subsequently a modified approach with single rib resection and sparing of latissimusdorsi has enabled in reducing this complication. Parietal wall hernia mostly occurs due to damage of the 11th & 12th intercostal nerves. This results in atrophy of the rectus and lateral abdominal wall musculature leading to parietal hernia without true facial defect. Obstruction in such cases is extremely unlikely and hence the management remains conservative.*

Keywords: dorsolumbar fracture, anterolateral mini thoracotomy, retroperitoneal approach, parietal wall hernia, intercostal nerve

1. Introduction

Mini open thoracotomy for thoracolumbar approach is a relatively new surgical technique that allows access to the thoracolumbar junction lumbar disc space and vertebral body without an extensive muscle dissection. It has become an increasingly popular approach for achieving kyphotic correction over the past decade because it can avoid the morbidity of posterior & anterolateral approaches [1]. As this retroperitoneal, retro plural approach has gained more widespread acceptance and increased utilization, recent interest has focused on understanding the morbidity and complication profile of the procedure [2]. The retroperitoneal approach is technically more suitable & easier access to the vertebra. An unsightly and painless abdominal flank bulge is a largely under-recognized and very rare complication of this approach [4]. Postoperatively, abdominal muscle laxity and flank bulge results in an uncomfortable, asymmetrical cosmetic deformity and dissatisfaction with physical appearance [3]. We conducted this study to

evaluate the incidence & pathophysiology of flank bulging after mini thoracotomy along with a literature review.

2. Materials and Methods

A retrospective analytical study of patients of traumatic dorsolumbar fractures was carried out in our institute which is tertiary care center, from Jan 2015 to June 2018. 130 patients underwent surgery for traumatic thoracolumbar fracture at our institute between Jan 2015 and Jun 2018 via anterolateral and posterior approach. A total of 50 patients out of 130 were managed by this retroperitoneal mini thoracotomy approach. The mean age of the retroperitoneal approach patients was 38 ± 7.2, (20 - 64) years old. The male to female ratio was 40:10 (M: F= 4:1). Out of these, 34 patients underwent single rib resection depending upon the level of fractured vertebra and 16 patients underwent excision of 11th & 12th ribs. This was followed by diaphragmatic sparing retroperitoneal approach for doing corpectomy, placement of expandable cage and fixation with screw and rod.

3. Postoperative Outcomes

The mean follows up of the patients was 18 months (Mean 2 - 30 months). Follow-up study in the outpatient clinic included a physical examination and thickness of the abdominal wall muscle was measured by follow-up computed tomography (CT) scan. CT scan was examined at the preoperative stage, one month and yearly in 28 patients. The thickness of the abdominal wall muscle was measured by Verniercaliper from CT films. The sites of measurement were the abdominal rectus muscle, the middle portion of the lateral abdominal wall muscles, and the maximum thickness of lateral abdominal wall muscles in the incision side at the navel level (Fig. 1).



Figure 1: Site of measurement of the lateral abdominal wall muscles

The change of muscle thickness was shown by the percentage change from the preoperative thickness. Compound muscle action potentials (CMAPs) of the abdominal muscle were examined for three patients with bulge (figure 2) and three patients having no bulge in order to assess the relationship between abdominal bulge and intercostal. nerve injury.



Figure 2: Representative image of patient with lateral abdominal bulge in one of the post-operative patients

CMAP was recorded by using a conventional electromyography machine from the abdominal rectus muscle, lateral abdominal wall muscle after stimulating the 11th & 12th intercostal nerves (figure 3 & 4).



Figure 3: Site of electrode placement for recording of CMAP

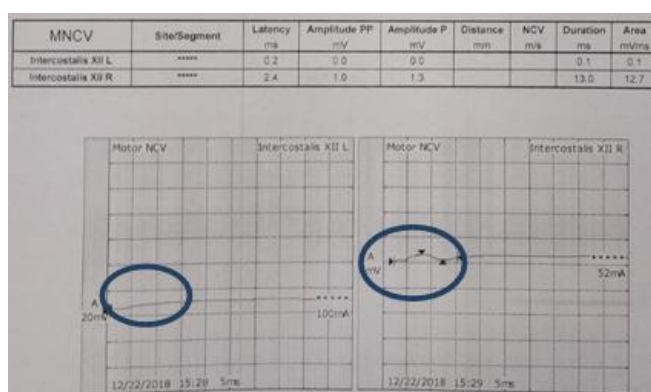


Figure 4: Recording showing absent tracing and potential wave form on the affected side (left)

4. Results

3 patients out of the 50 (6%) patients developed abdominal bulge by CT scan in addition to inspection and palpation.(figure 5 & 6).



Figure 5: Representative image in one of the post – operative patients having abdominal bulge depicting atrophy of lateral abdominal muscles (left) as compared to right



Figure 6: Representative image showing post operative lateral abdominal bulge in one of the patients

The onset of abdominal bulge in these patients was on the postoperative first, sixth, and eleventh month. One of the bulge patients was associated with wound hypoesthesia which disappeared after the third postoperative month. The thickness of the abdominal wall muscle was reduced at the operated site as measured on CT vis a vis the normal side. . However, none of these patients showed features of obstruction. Decrease in the thickness of the abdominal wall muscle was attributable largely to decrease in the thickness of the lateral wall muscle. CAMP of abdominal rectus muscle in non-bulge patients did not show a uniform tendency. Their CAMP of the incision side did not disappear. On the other hand, CMAP of abdominal rectus muscle was low/non recordable in comparison to the contralateral side (Table 2).

Table 2: Combined muscle action potentials abdominal rectus muscle

	AGE	GENDRE	RIGHT	AMPLITU DE(mV)	AREA (mVms)	LEFT	AMPLITU DE(Mv)	AREA(mV ms)
NON BULGE GROUP								
1	36	M		2.0	28		1.7	18
2	38	M		1.8	22		1.8	20
3	52	F		2.2	32		1.6	22
BULGE GROUP								
4	46	M		2.4	28		0	0
5	30	M		2.1	26		0.1	0.2
6	40	F		1.8	28		0	0

Table 2: CMAP of abdominal rectus muscle was low/non recordable in comparison to the contralateral side.

5. Discussion

A novel approach for thoraco-lumbarfractures through mini-open thoracotomy via retroperitoneal retropleural with diaphragm sparing with expandable cage fixation This procedure has been shown to have decreased blood loss, lower rates of postoperative back pain, quicker recovery, and shorter hospital stays Parietal wall/Phantom hernia is an unsightly and painless abdominal flank bulge is a largely under-recognized and very rare complication of this approach [6]. This results in an uncomfortable, asymmetrical cosmetic deformity [1]. We observe flank bulging after mini thoracotomy retroperitoneal approach along with a literature review. However, considerable controversy continues regarding the preferred operative approach for thoracolumbar fracture [3]. Thus, mini open thoracotomy retroperitoneal novel approach through an oblique incision has some complications concerning

wounds due to muscle splitting [4, 5]. The incidence of abdominal bulge is reported as 11%–12% [1]. Abdominal bulge was found in 6% of our series. 8) Cadaveric dissections have shown that the most significant intercostal nerve contributions to the anterolateral abdominal wall arise from T11 and T12 [2]. Electrophysiological confirmation of these findings was obtained through intraoperative stimulation. According to Gardner's paper [1], the extension of the incision into the 11th& 12th intercostal space and following injury of the 11th intercostal nerve is regarded as the primary cause for occurrence of postoperative abdominal flank bulge [1]. Our results also revealed that abdominal bulge is related to intercostal nerve injury. In the abdominal bulge case, disappearance of CMAP in the incision side indicates axon degeneration of the motor nerve [4]. We demonstrated that atrophy of the abdominal wall muscle was found even in non-bulge cases. These facts show that the muscle atrophy

induced by denervation of the eleventh intercostal nerve is the cause of abdominal bulge [7]. According to Fahim's paper, the 12th intercostal nerve injury is also related to the bulge formation from the innervations of abdominal wall muscle [2]. However, as we modified our approach for thoracotomy, so as not to extend the incision into the 12th intercostal space. We believe that an effective treatment of abdominal bulge currently doesn't exist. Therefore, it is important to prevent abdominal bulge. The postoperative abdominal flank bulging is caused by direct muscular injury and disruption of the local blood supply to the muscle around the incision [6]. However, there is abundant evidence that implicates denervation injury as the more likely cause [8]. The pseudohernia is distinct entity from a true abdominal hernia related to the distal to the incision causing denervation injury in that it affects the ipsilateral abdominal wall musculature [3]. If it is a true hernia involve facial defect, a reoperation for repair is required. Whereas, if it is a denervation injury, thinning of the musculature with an intact facial plane it is only necessary to observe the abdominal flank bulging [10]. In our case, the abdominal flank bulging showed an oblique and dermatomal pattern below the skin incision. An abdominal CT scan showed no facial defect [11]. Therefore, it is not an incisional hernia. It is abdominal flank bulging due to abdominal muscle weakness caused by injury to the T11 intercostal nerve. The causes of this complication are excessive irritation of intercostal neurovascular bundle during periosteal dissection using dissector, excessively prolonged retraction of the 10th and 12th rib, with 11th intercostal neurovascular bundle, to secure a wide operational view [9]. We modified our approach with single rib resection and sparing of latissimusdorsi, limiting the skin incision to midaxillary line with avoiding double rib cutting. We believe that, it is important to prevent abdominal bulge as of now an effective treatment of abdominal bulge currently not exists [12]. Meticulous dissection of neurovascular bundle & placement of moistened cottonoid or laparotomy sponge & awareness of the anatomical course of the intercostal nerve is most important measure for prevention.

6. Conclusions

All these 3 patients of parietal hernia had undergone resection of two ribs (11th & 12th) and were the initial cases of this study. Subsequently a modified approach with single rib resection and sparing of latissimusdorsi has enabled in reducing this complication. Parietal wall hernia is a type of incisional hernia and mostly occurs due to damage of the intercostal nerves. This results in atrophy of the rectus and lateral abdominal wall musculature leading to parietal hernia. Obstruction in such cases is extremely unlikely and hence the management remains conservative. Awareness of the anatomical course of the intercostal nerve with neurovascular bundle retraction, a meticulous approach intended to minimize intercostal nerve injury is the first step in preventing this complication.

References

- [1] Gardner GP, Josephs LG, Rosca M, et al. The retroperitoneal incision. An evaluation of postoperative flank 'bulge'. *Arch Surg* 1994; 129: 753-6.
- [2] Fahim DK, Kim SD, Cho D, et al. Avoiding abdominal flank bulge after anterolateral approaches to the thoracolumbar spine: cadaveric study and electrophysiological investigation. *J Neurosurg Spine* 2011; 15: 532-40.
- [3] Jagannathan J, Chankaew E, Urban P, Dumont AS, Sansur CA, Kern J, et al: Cosmetic and functional outcomes following paramedian and anterolateral retroperitoneal access in anterior lumbar spine surgery. *Clinical article. J Neurosurg Spine* 9:454-465, 2008
- [4] Hayashida N, Masuda M, Pearce Y, Kuwabara S. Wound complications of the retroperitoneal approach for the abdominal aortic aneurysm repair-an evaluation of abdominal bulge formation-. *Ann Vasc Dis.* 2014;7(1):17-20
- [5] Moro T, Kikuchi S, Konno S, Yaginuma H: An anatomic study of the lumbar plexus with respect to retroperitoneal endoscopic surgery. *Spine (Phila Pa 1976)* 28:423-428, 2003
- [6] Van Ramshorst GH, Kleinrensink GJ, Hermans JJ, Terkivatan T, Lange JF: Abdominal wall paresis as a complication of laparoscopic surgery. *Hernia* 13:539-543, 2009
- [7] Kevin S. Cahill, Joseph L. Martinez et al. Motor nerve injuries following the minimally invasive lateral transpoas approach. *Clinical article. J Neurosurg Spine* 17:227-231, 2012
- [8] Jeong-Hoon Choi, Jee-Soo Jang, 1 and Il-Tae Jang2. Abdominal Flank Bulging after Lateral Retroperitoneal Approach: A Case Report *NMC Case Report Journal* 2017; 4: 23-26
- [9] Timmermans L, Klitsie PJ, Maat AP, de Goede B, Kleinrensink GJ, Lange JF: Abdominal wall bulging after thoracic surgery, an underdiagnosed wound complication. *Hernia* 17: 89-94, 2013
- [10] Hoffman RS, Smink DS, Noone RB, Noone RB Jr, Smink RD: Surgical repair of the abdominal bulge: correction of a complication of the flank incision for retroperitoneal surgery. *J Am CollSurg* 199: 830-835, 2004
- [11] Goodman P, Balachandran S: Postoperative atrophy of abdominal wall musculature: CT demonstration. *J Comput Assist Tomogr* 15: 989-993, 1991
- [12] Salameh JR, Salloum EJ: Lumbar incisional hernias: diagnostic and management dilemma. *JLSLS* 8: 391-394, 2004
- [1] Gardner GP, Josephs LG, Rosca M, et al. The retroperitoneal incision. An evaluation of