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Case Series

Superior mediastinal tumour excision through upper partial sternotomy and chamberlain incision

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ABSTRACT

Superior mediastinal mass excision can be performed by various approaches such as partial sternotomy, mini trapdoor incision, anterior cervical transsternal approach and lateral thoracotomies. However, adequate exposure especially of superior surface seems to be difficult. Total four patients of superior mediastinal mass were admitted in the department of cardiothoracic and vascular surgery, Safdarjung hospital, New Delhi between June 2019 to May 2021. All of them were operated by upper partial sternotomy with right or left chamberlain extension of incision. It is safe and effective in terms of exposure with early recovery as well as cosmesis. Hence, we advocate the use of upper partial sternotomy with left or right chamberlain incision which provides good exposure in addition to ease of patient position, vascular control and emergency institution of cardiopulmonary bypass.

Keywords: Superior mediastinal tumour, Chamberlain incision, Partial sternotomy

INTRODUCTION

Superior mediastinum is an artificially divided wedge-shaped compartment of the mediastinum located between the thoracic plane inferiorly and the thoracic inlet superiorly. Owing to close relationship with trachea, subclavian vessels and vagus nerve tumours in this area are one of the most difficult regions for surgical exposure. With standard posterolateral thoracotomy limited exposure of vascular and neural structures at superior aspect of tumours is attained.[1] Thus, various other approaches are gaining popularity for such tumours namely, partial sternotomy, mini trapdoor incision and anterior cervical transsternal approach. Out of these, partial sternotomy has evolved and gained popularity in cardiac surgery but its use for superior mediastinal exposure is still evolving.[2-4] Keeping in view the difficulties faced while approaching upper mediastinal tumours we have developed our own modification of upper partial sternotomy by extending it to right or left chamberlain incision. Herein, we describe four patients diagnosed with superior mediastinal tumour from different origin undergoing surgery through upper partial sternotomy with extension to left or right chamberlain incision. The study deals with advantages of this technique over the traditional approach.

CASE SERIES

Total four patients of superior mediastinal mass were operated in the department of cardiothoracic and vascular surgery, Safdarjung hospital, New Delhi between June 2019 to May 2021. All patients were operated by upper partial sternotomy with chamberlain extension of incision (Figure 1).

Patient 1: A 40-year female, though asymptomatic diagnosed to have right apical opacity in chest X-ray

(Figure 2), which was a heterogenous mass in the right paravertebral region extending to neural canal (Figure 3). Fine needle aspiration cytology (FNAC) was suggestive of leiomyoma and tumour was excised by upper partial sternotomy with right chamberlain extension of incision. Intra-operatively, patient exsanguinated from the paravertebral venous plexus for which patient was placed on cardiopulmonary bypass (CPB) after converting to median sternotomy (Table 1).

Patient 2: A 20-year female, with history of persistent cough for two months, found to have right paratracheal opacity in chest x-ray. Contrast enhanced computed tomography (CECT) was suggestive of right paratracheal mass with calcification, FNAC was suggestive of leiomyoma. Intra-operatively, the margins of the tumour were well defined. Procedure was uneventful (Table 1).

Patient 3: A 32-years old female presented with shortness of breath and difficulty in swallowing for two months. She was found to have left paratracheal opacity in chest x-ray and CECT showed calcification in the mass (Figure 3), however, FNAC was inconclusive. Tumour was excised by upper partial sternotomy with left chamberlain extension of incision (Figure 4). Mass was calcified; hence biopsy could not be done.

Patient 4: A 30-year female patient presented with respiratory distress for which she was intubated. Chest x-ray showed right paratracheal opacity, whereas CECT showed anterior mediastinal mass in the pre-tracheal and pre-carinal region extending to the right paratracheal region. FNAC through fibreoptic bronchoscopy was suggestive of thymoma. Patient was initially approached partial upper sternotomy but later converted to total median sternotomy due to pericardial involvement. Biopsy report was suggestive of thymoma.

Operative data and postoperative outcome of all patients have been shown in Table 2 and 3.

Table 1: Clinical data of all four patients.

Age (years)	Sex	Symptoms	Chest X-ray	CECT finding	Technique of biopsy	Preoperative biopsy
40	Female	Incidental finding asymptomatic	Right apical opacity	6×4×4 cm heterogenous mass in right paravertebral region with foraminal exclusion from D1 and D2 nerve root	FNAC	Leiomyoma
20	Female	Chronic cough	Right paratracheal opacity	8×8×6 cm heterogenous mass with calcification in right paratracheal region	FNAC	Leiomyoma
32	Female	Shortness of breath, difficulty in the swallowing	Left paratracheal opacity	5×4×4 cm heterogenous mass with calcification in left paratracheal region	FNAC	Inconclusive
30	Female	Shortness of breath, orthopnoea	Right paratracheal opacity	5×7×9 cm heterogenous mass in anterior mediastinum extending to superior mediastinum, pre-tracheal and pre-carinal region	FNAC	Inconclusive

Table 2: Operative data.

Surgical approach	Surgical extension	Intraoperative finding	Perioperative complications	Duration of surgery (Hours)
Partial upper sternotomy with right chamberlain	Median Sternotomy	6×4×4 cm cystic mass in right posterior mediastinum with pedicle extension to D2 vertebral foramina	Catastrophic bleeding leading to emergent CPB	5
Partial upper sternotomy with right chamberlain	Nil	8×8×8 cm well defined firm right paratracheal mass	Nil	2.5
Partial upper sternotomy with left chamberlain	Nil	5×3×4 cm well defined calcified left paratracheal mass	Nil	3
Partial upper sternotomy with right chamberlain	Median sternotomy	3×4 cm thymic mass in superior mediastinum with adherence to carina and right bronchus posteriorly	Nil	5

Table 3: Post-operative outcome.

Post-operative hospital stays (Days)	Post-operative analgesia	Biopsy	Follow up	
			3 months	6 months
7	Non opioid	Schwannoma	Normal	Normal
5	Non opioid	Leiomyoma	Normal	Normal
5	Non opioid	Calcified lymph node	Normal	Normal
10	Opioid	Thymoma	Normal	Normal

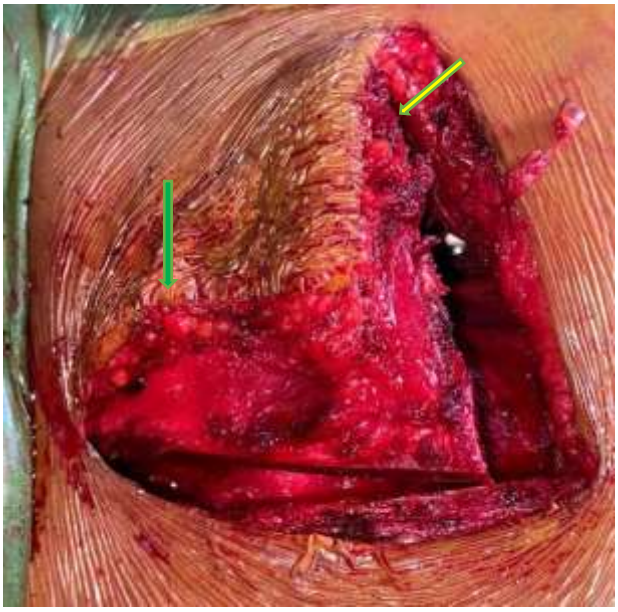

Figure 1: Upper partial sternotomy extended to left chamberlain incision (Yellow arrow: Left chamberlain incision, green arrow: Upper partial sternotomy).

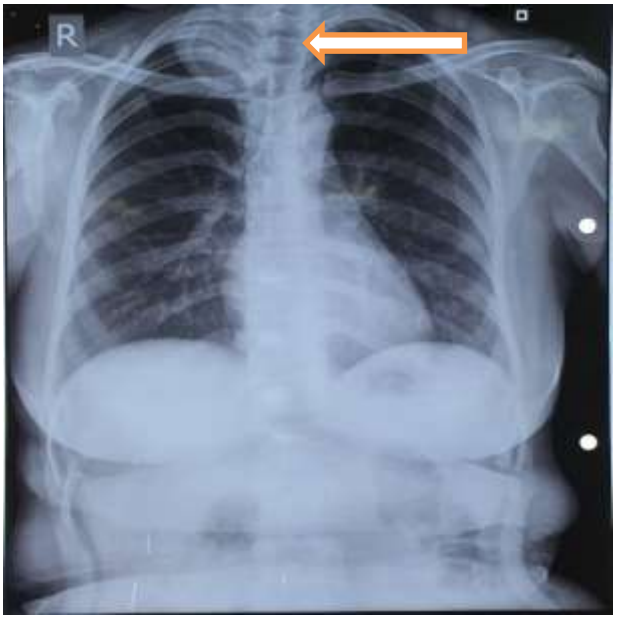

Figure 2: Chest X-ray PA view of the right apical opacity (arrow).

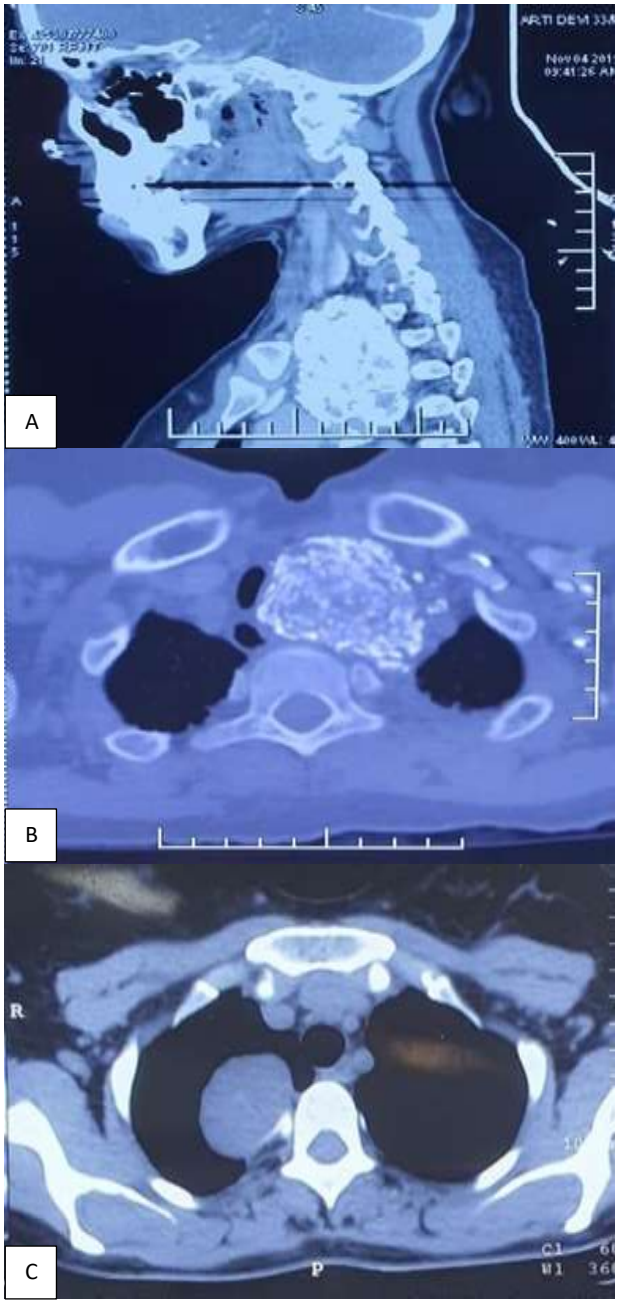

Figure 3 (A-C): CECT chest of (5×4×4 cm) heterogenous mass with calcification in left paratracheal region. CECT chest of (6×4×4 cm) heterogenous mass in right paravertebral region with foraminal exclusion from D1 and D2 nerve root.

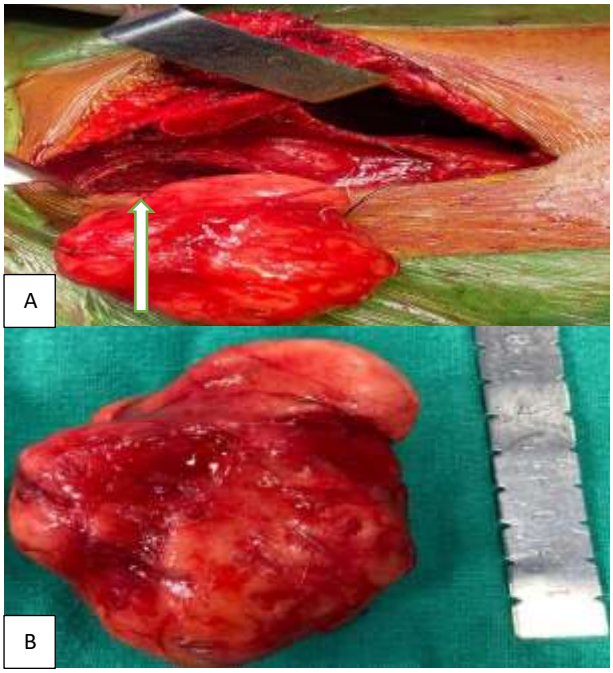

Figure 4 (A and B): Intra-operative finding and post-operative specimen of calcified left paratracheal mass (Arrow).

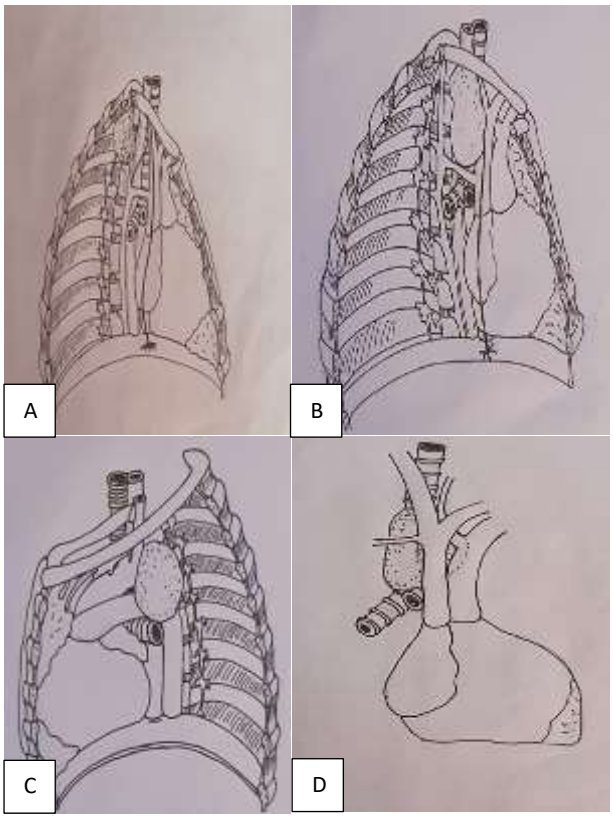

Figure 5 (A-D): Schematic diagram showing intraoperative findings. Cystic mass in right posterior mediastinum. Well, defined firm right paratracheal mass. Well, defined calcified left paratracheal mass and thymic mass in superior mediastinum with adherence to carina and right bronchus posteriorly.

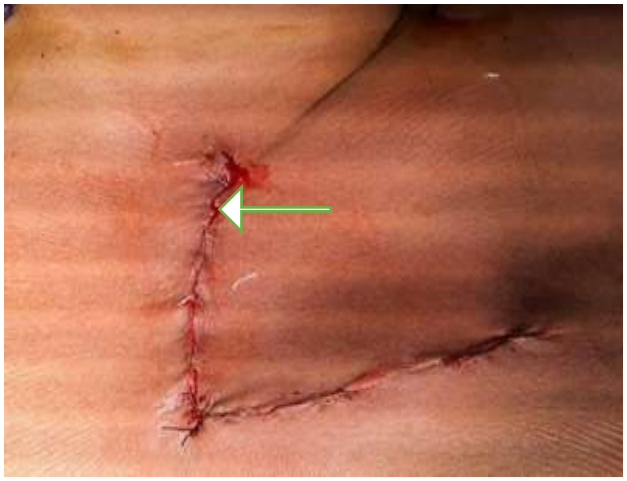

Figure 6: Post-operative scar (arrow: head end).

Technique

Patient is placed in supine position with neck hyperextended. Following painting and draping the patient, upper partial sternotomy is performed up to 3rd intercostal space and extended to right or left chamberlain incision according to site of tumour. Thorax was entered through 2nd intercostal space. A chest retractor is placed to spread the sternum which provides an excellent operative field for resecting the mass. Size and extent of tumour was assessed along with its relations to surrounding structures, i.e., arch of aorta, arch vessels, trachea, vagus nerve and posteriorly spine. Tumour excision was done by blunt dissection. Haemostasis was achieved. Pleural and mediastinal drains were placed accordingly and wound was closed.

DISCUSSION

Mediastinal tumours are a rare entity and usually diagnosed in patients between 30 to 50 years of age. In our series all four patients fell in this group with mean age 30.5 years. In our literature search we did not find the prevalence of disease in females, however, in our study all four patients were female. It's a site for wide range of neoplasms with rare histology. Out of all the tumours those located in superior mediastinum are exceptional difficulty in view of surgical exposure due to their close proximity to trachea, subclavian vessels and vagus nerve. Complete resection of tumour is required to establish diagnosis or to relieve or prevent compressive symptoms and because of the concern of malignancy (2% to 3%).[5]

Initial choice of investigation for definitive diagnosis of mediastinal mass following chest X-ray is computed tomography (CT).[6] It is valuable in delineating morphology of tumour, its anatomical location and its relation with other structures in mediastinum. Contrast enhanced high resolution CT with multiplanar and 3D reconstruction is used to delineate blood supply to mediastinal mass and its feeding vessels and thus facilitate an optimal surgical resection.[7]

Commonly used surgical approaches for treatment of mediastinal tumour range from lateral thoracotomies to median sternotomy and the less common approaches include clamshell and hemi clamshell incision. These standard approaches provide limited exposure at the superior aspect of tumours, thus various other approaches have been developed, namely, partial sternotomy, mini trapdoor incision and anterior cervical transsternal approach. Use of partial sternotomy has evolved and gained popularity in cardiac surgery for minimally invasive cardiac surgery.[2] There have been various reports of its utility in general thoracic surgery, but its use for superior mediastinum exposure has not been widely reported.[3,4] Although its true utilization rates are unknown, partial upper sternotomy provides excellent exposure for anterior mediastinum as compared to anterior or anterolateral thoracotomy for both vascular and nonvascular structures in superior mediastinum.[8] Further this incision can be extended to left or right chamberlain incision for better visibility of even posterior hilum. This approach also offers multiple advantages in terms of patient position, vascular control and ease of instituting cardiopulmonary bypass in case of inadvertent bleeding.[8] The most critical step in resection of mediastinal mass in apex is its superior surface excision which is difficult by conventional posterolateral or anterolateral thoracotomy. However, our technique provided adequate exposure for superior surface dissection. Additionally, variety of resection procedures including small to moderate size thymoma can also be performed.[9]

According to our institutional experience, upper partial sternotomy extended to right/left chamberlain incision provides optimal exposure along with limited morbidity. Similar results have been reported by other reports. Shiptzer et al have reported outcome of seventeen patients who underwent partial sternotomy.[10] Alifano et al have also reported outcomes of 100 patients undergoing upper partial sternotomy.[11] Both the reports have concluded that exposure by this approach is satisfactory as well as safe with no surgical mortality and minimum morbidity.[10,11]

Other less invasive approaches to superior mediastinum have been described, namely, cervical neck incision, thoracotomy or video assisted thoracoscopic surgery (VATS), but these have their own limitations.[12] Cervical incision provides limited exposure. Similarly, VATS provides very limited exposure to ipsilateral mediastinum with poor access to vascular and nonvascular structures. Access to contralateral mediastinum is also negligible unless bilateral VATS is performed also VATS seem unsuitable for large masses, especially tumours more than 10 cm.[12-14]

Median sternotomy provides better approach for large thymomas or those with invasion of mediastinal structures. Paul et al had reported the use of full sternotomy for thymic resection and pericardial fat in myasthenia gravis.[9] Similar approach was adopted in first and fourth patient in our study.

The post-operative outcomes of above stated incision are consistent with that reported by Kido and associates, i.e., less post-operative hospital stay, early recovery as well as lesser use of opioid for analgesia as compared with median sternotomy or lateral thoracotomy.[15]

The results of this study provide further evidence that upper partial sternotomy is an effective and safe incision for excision of superior mediastinal tumours. Along with this we recommend extending incision to right or left chamberlain incision which provides added advantage of good surgical exposure along with ease for achieving haemostasis or for instituting CPB if required.

CONCLUSION

Upper partial sternotomy along with right or left chamberlain incision is not only safe and effective means for exposure but also provides good postoperative outcome in context of early recovery as well as cosmesis.

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