Peer Review File
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Reviewer A

Impression: "The Authors presented their initial experience with robotic chest wall resection both for primary chest wall lesions and invasive lung cancer reporting general data from the national database (NCBD) on this issue. The manuscript in well written and interesting but some points should be reviewed."

Reply: We thank the reviewer for their kind and thoughtful review of our manuscript.

Comment A.1: "In the Methods section no selection criteria for patients are shown. How do you select patients for robotic chest wall resection? Why robotic technique was chosen over others?"

Reply A.1: Thank you for the thoughtful comment. At our institution, a robotic approach is the preferred approach for surgeons. The robot is used for all cases to start. Tumors that involve major vascular structures, the sternum, or are over 10 cm in largest dimension are excluded from a robotic approach. Additionally, we exclude resections that are known preoperatively to require a chest wall reconstruction from a robotic chest wall resection.

The following changes have been made in the manuscript:
[Methods, 1st paragraph]: At our institution, the robotic approach is the preferred technique for our surgeons. We favor the robotic approach because we believe the technology affords several advantages. The three-dimensional magnification and wristed instruments allow for precise dissection, maximizing hemostasis and minimizing intraoperative blood loss. The overlying chest musculature is preserved and provides adequate strength to chest wall which negates the need for a formal chest wall reconstruction, keeping rib spreading to a minimum and significantly reducing postoperative pain. However, patients with tumors involving major vascular structures, involving the sternum, or are over 10 cm in largest dimension are generally excluded from a robotic approach. Although not described in our experience, chest wall reconstruction is potentially also doable robotically (9).

9Demmy TL, Yendamuri S, Hennon MW, Dexter EU, Picone AL, Nwogu C. Thoracoscopic maneuvers for chest wall resection and reconstruction. J Thorac Cardiovasc Surg. 2012;144:S52-7.

Comment A.2: "As stated by the Authors limited data on robotic chest wall resection are available in the Literature. Being so the study needs an enhancement about pre-operative planning and description of operative technique (e.g. what was the port

placement and size? How do you manage the neurovascular bundle? Do you take frozen section analysis of the specimen margins? Procedures were conducted by an experienced robotic surgeon?). I think these changes would enhance the instructive value of the article together with intraoperative images or videos. In the same way line 239-246 should be moved from Discussion section to "Operative technique" in the Methods section."

Reply A.2: We thank the reviewer for their clarifying comments. However, we believe the discussion lines 239-246 are pertinent to the discussion as they involve our opinion on the superiority of the robotic technique. The statements made there do not inform how to perform the resection, but rather why we think robotic chest wall resection should be more widely adapted. We have included a brief summary of our view of the advantages of robotic chest wall section in the methods.

As regarding port placement, we place our ports in the same arrangement for all cases. Our preferred port placement approach is 4 robotic ports (three 8 ports and one 12 port) all in line in the 8th intercostal space. However, we are flexible with port placement to optimize triangulation to lesion after insertion of first camera port to allow triangulation to tumor. In cases the reason why we opt for the 4 in line ports is we believe that when a lung resection is necessary the hilar dissection is the most important part of the operation. The chest wall portion is performed at the end after the hilar dissection is completed.

We manage the neurovascular bundle intrathoracically with the robotic clip applier.

For tumors arising from the bone, gross margin assessment is utilized as it is not feasible to decalcify bone and obtain microscopic frozen section margin analysis within the duration of the operation. We follow standard chest wall resection guidelines for primary chest wall tumors of obtaining 4 cm margin grossly as established by the study by King et al.

All procedures were conducted by experienced robotic thoracic surgeons who perform over 100 robotic thoracic operations per year.

We have also included a video of the operative technique for publication to enhance the illustration of our operative technique.

We prefer the robotic approach at our institution because we believe the technology affords several advantages. The three-dimensional magnification and wristed instruments allow for precise dissection, maximizing hemostasis and minimizing intraoperative blood loss. The overlying chest musculature is preserved and provides adequate strength to chest wall which negates the need for a formal chest wall reconstruction, keeping rib spreading to a minimum and significantly reducing

postoperative pain.

The following changes have been made to the manuscript:
[Methods, 3rd paragraph]: The patient is placed in the lateral decubitus position. Our preferred port placement consists of 4 robotic ports (three 8 mm ports and one 12 mm port) all in line in the 8th intercostal space. However, we are flexible with port placement to optimize triangulation to the lesion after the insertion of the first camera port to allow triangulation to tumor. We opt for the four in line ports because we believe when a lung resection is necessary the hilar dissection is the most important part of the operation. The chest wall portion is performed at the end after the hilar dissection is completed. After port placement and initial chest exploration, we dissect the affected ribs free from the surrounding intercostal muscle. We ligate the neurovascular bundle with robotic clips. The proximal and distal aspects of the affected rib(s) are divided, taking into account an adequate margin. Multiple techniques or instruments can be used for this portion, including the Gigli saw, Kerrison rongeurs, Dennis rib cutter, or Chisel rib shear via a thoracic port or separate stab skin incision depending on the access to the location of the bony division. The specimen is then placed in a specimen bag and retrieved with care, ensuring that the sharp edges of the bone are oriented to allow for easy extraction and prevent tearing the bag or injuring viscera. In cases where a concomitant en-bloc lung resection was required, we prefer first to perform the hilar lung dissection, complete the fissure, and then perform the chest wall resection en-bloc. For tumors arising from the bone, gross margin assessment is utilized as it is not feasible to decalcify bone and obtain microscopic frozen section margin analysis within the duration of the operation. We follow standard chest wall resection guidelines for primary chest wall tumors of obtaining 4 cm margin grossly (9). In all cases, we were able to preserve the overlying extra-thoracic musculatures. These muscles provide adequate coverage to prevent pulmonary herniation. Thus, prosthetic reconstruction of the chest wall was not required in this series. See Video 1 for a demonstration of our operative techniques taken from Case 3 in this series. All procedures were conducted by experienced robotic thoracic surgeons who perform over 100 robotic thoracic operations per year.

Comment A.3: “Again due to the lack of data in the Literature, the new article released by Burt BM should be taken into account and cited (Robotic First Rib Resection and Robotic Chest Wall Resection. Egyud MRL, Burt BM. Thorac Surg Clin. 2023 Feb;33(1):71-79. doi: 10.1016/j.thorsurg.2022.08.003.PMID: 36372535 Review).”

Reply A.3: Thank you for the updated reference. We have incorporated Egyud et al. and two other contemporary papers regarding primary chest wall resection. Please see Reply to Editorial comment E for detailed changes to the manuscript.

Comment A.4: “In the Results section, line 137-139 (and consequently in Table 3), the Authors compare the median tumor size of their series with that of NCBD series. I’m afraid the entire specimen size was taken into account for your six patients rather than

the tumor size, as reported in “Case presentation” and Table 2. In fact, a mean size of 11.4cm is reported with minimum and maximum size of 2.5 and 22.2cm respectively, that are the maximum and minimum diameters reported for your specimens, while in the case presentation none of the descripted tumors shows a maximum diameter of 22.2cm.”

Reply A.4: We thank the reviewer for the correction to our reporting. We have made the following changes to the manuscript.

The following changes have been made to the manuscript:
[Results, 3rd paragraph]: Median tumor size was somewhat larger in our institutional series compared to the NCDB, 5.25 cm (range 2.3-8.3) versus 3.9 cm (interquartile range 2.4-6).

[Discussion, 6th paragraph]: We had somewhat larger median tumor size at 5.25 cm vs. 3.9 cm nationally. This highlights our operative technique engenders a quick recovery with an average hospital length of stay of 3 days over national data.

[Results, Case 1]: Final pathology revealed fibrous dysplasia with the third rib tumor measuring 7.7x5.7x4.1 cm and the tenth rib tumor measuring 4.3x4.1x3.1 cm.

[Results, Case 2]: The pathological examination revealed a fibrous tumor with myxoid changes measuring 6.0x4.5x4.2 cm.

[Results, Case 3]: Pathological examination revealed Langerhans cell histiocytosis which measured 2.3x0.8x0.4 cm.

[Results, Case 4]: Pathological examination revealed moderately differentiated squamous cell carcinoma stage pT3N0Mx with the tumor measuring 8.3x5.2x3.0 cm.

[Results, Case 5]: Pathological examination revealed poorly differentiated metastatic adenosquamous carcinoma, stage pT3N0M1b with tumor measuring 4.5x3.7x2.2 cm.

Comment A.5: “No mention is given to the tumor margins, there were all R0 resections? Were the oncological margins respected? As is well known, the tumor margins are a main character in chest wall resection and the tumor-free margin diameter varies between the different histological features.”

Reply A.5: We thank the reviewer for their comment. In the Methods within the Operative Technique section, we stated that adequate tumor margins were taken into account for all resections.

For primary malignant chest wall tumors, a 4 cm margin is pursued unless this is not

technically feasible for example if 4 cm would require resection of a vertebral body.

For lung cancer invading the chest wall we pursue a negative margin. Generally speaking, surgeons agree on grossly resecting between 2-4 cm on either end.

For benign chest wall tumors there is no margin requirement.

We have made the following changes to the manuscript:
[Methods, Operative Technique]: For tumors arising from the bone, gross margin assessment is utilized as it is not feasible to decalcify bone and obtain microscopic frozen section margin analysis within the duration of the operation. We follow standard chest wall resection guidelines for primary chest wall tumors of obtaining 4 cm margin grossly (10).

10King RM, Pairolero PC, Trastek VF, Piehler JM, Payne WS, Bernatz PE. Primary chest wall tumors: factors affecting survival. Ann Thorac Surg. 1986;41:597-601.

Comment A.6: “In the Discussion section a highlight on patients’ selection, pre-operative planning and operative technique should be given. Moreover, what could be the advantages of robotic technique over the other procedures in the management of chest wall lesions in the Authors’ opinion?”

Reply A.6: Thank you for thoughtful comments. We had included a description of what we believe to be the benefits of the robot in chest wall resection in the discussion, paragraph 5. We included our preoperative workup in the Methods section under operative technique.

Please see Reply A.1 for detailed changes to the manuscript on this topic.

Reviewer B

Impression: “This article focuses on robotic chest wall resection in the single institution, and summaries national experience of robotic chest wall resection: 6 cases in the authors’ institution, and 96 cases in national cancer database. In the authors’ institution, 3 (50%) cases were primary chest wall tumors. Tumor size was 11.4 cm in the authors’ institution vs 3.9 cm in national cancer database. Their clinical outcomes were acceptable.

I have some questions. As the authors concluded, robot chest wall resection is feasible, but the merit or demerit is not clearly described.”

Reply: We thank the reviewer for their kind and thoughtful Reply to our research. We believe that the merit of robotic chest wall resection is described in paragraphs 3 and 5 of the discussion section. Additionally, we believe the reporting of our median length

of stay of 3 days, our excellent functional outcomes reported at the end of each case description, and our success in treating pain with minimal opiates (noted in the body of each case description) also serve as indications of the merits of our robotic approach.

Comment B.1: “In the robotic chest wall resection, the authors used multiple techniques or instruments including the Gigli saw, Kerrison rongeurs, Dennis rib cutter, or Chisel rib shear. Are these instruments handled by the robot arm? The descriptions and photos regarding operative techniques are not enough for readers. Please add intraoperative images per steps. Are extra-thoracic muscles divided or sutured from the inside by the robot? How do the authors reconstruct chest wall using robot?”

Reply B.1: We thank the reviewer for their clarifying comments. The instruments to divide the ribs are not attached to a robotic arm. They are manually operated. The instruments were either introduced through a thoracic port site after removing the port or utilized by making a separate stab incision over the margin of resection. The resected ribs are dissected from their musculature intrathoracically utilizing robotic instruments which is stated in the second paragraph of the Operative Technique section under Methods. Regarding reconstruction, we believe that by dissecting the ribs intrathoracically from the musculature keeps the musculature intact and provides adequate stability to prevent lung herniation which is stated at the end of the Operative Technique section of the Methods.

Additionally, we have included a video demonstrating our operative methods taken from Case 3’s surgery that we think will be very helpful to understand our operative technique.

The following changes have been made to the manuscript:
[Methods, Operative Technique]: For the Gigli saw, we make a stab wound above and below the rib. The Gigli saw is inserted percutaneously and operated manually external to the thoracic cavity. To operate the Kerrison rongeur, one arm of the robot is undocked, and the instrument is inserted through the port site using the robotic camera as a guide. All the rib shearing techniques are manually operated and do not use the robot except for the camera and graspers as needed.

[Methods, Operative Technique]: See Video 1 for a demonstration of our operative techniques taken from Case 3 in this series.

Comment B.2: “Thank you for the detail information of each patient. All tumor size doesn’t reach 11.4 cm. Is tumor size correct? Operation time?”

Reply B.2: Thank you for your discerning comments. We have corrected the tumor sizes in the manuscript, please refer to Reply A.4 for the specific changes.

We report the median operative time of our case series in the second paragraph of the

Results section. The median operative time was 215 minutes, and the range was 134 minutes to 299 minutes.

Comment B.3: “Please expand discussions regarding the potential benefit of robot chest wall resection in comparison with the one via conventional thoracotomy or VATS. I think robot seems to be unsuitable for chest wall reconstruction. Chest wall reconstruction requires the different procedures from the outside of the chest.”

Reply B.3: We thank the reviewer for their comments. We believe robotic chest wall resection is an underutilized technique with many advantages to the traditional open thoracotomy approach including minimizing pain, bleeding, length of hospital stay, and maximizing functional outcomes which are reported in the body of each case description. We also have a further discussion on the merits of robotic surgery over open and VATS in paragraphs 3 and 5 of the discussion section. Additionally, our technique of dissecting the ribs from the musculature intrathoracically leaves the fascial planes of the chest wall muscles intact and provides enough support to prevent lung herniation and does not require external chest wall reconstruction. This is described in the Methods, Operative Technique section.

We did not offer robotic chest wall resection to patients who we considered would need a formal reconstruction based upon our exclusion criteria of tumors 10 cm or greater. However, techniques have been described in the literature demonstrating the feasibility of a minimally invasive chest wall reconstruction. Demmy et al. compiled all examples of thoracoscopic chest wall reconstruction they found and demonstrated a small series of completely thoracoscopic reconstructions of the chest wall has been performed. One technique described was using the Carter-Thompson laparoscopic port closure system (a device designed to pass suture through full thickness fascia to prevent port site hernias in the abdomen) via a stab incision while utilizing the thoracoscopic camera for visualization to anchor the prosthetic reconstructive material to the ribs.

Given our institutional series results and examples of completely thoracoscopic/percutaneous chest wall reconstruction, we believe that the robotic surgery platform has much potential in the field of chest wall resection and is uniquely suited to this task given its superior three-dimensional visualization, jointed instruments affording ease of access to certain parts of the thorax that traditional VATS has a difficult time with such as the apex, and the ability of the surgeon to perform these difficult operations in an ergonomic manner at the robot console.

Demmy TL, Yendamuri S, Hennon MW, Dexter EU, Picone AL, Nwogu C. Thoracoscopic maneuvers for chest wall resection and reconstruction. J Thorac Cardiovasc Surg. 2012;144:S52-7.

Reviewer C

Impression: “Dr. Raymond and colleagues have addressed a very interesting topic but tackled in a very superficial way. Furthermore, the particularly limited series adds nothing to what is already known in the treatment of primary tumors of the chest wall with a minimally invasive technique. I believe that a paper like this today is out of time to talk about initial experience, if not in one's own division. I think it is more appropriate that this work be presented at a congress rather than sent to a scientific journal.
I have never seen the size of the surgical specimen reported rather than the size of the removed lesion. It is not mentioned, how the diagnosis was obtained and whether it somehow more influence the type of resection, including the width of the margins.
"Median tumor size was larger in our institutional series than in the NCDB, 11.4 cm (range 138 2.5-22.2) versus 3.9 cm (interquartile range 2.4-6)." probably because you considered the size of the excised sample while the others considered the size of the tumor...
Among other things, the initial experience on an approach of this type should be done on small lesions and not on lesions of 22 cm, even if we understood that perhaps the lesion was much smaller.”

Reply: We thank the reviewer for their insightful comments. We have corrected the erroneous tumor sizes. Please see Comment A.4 for detailed changes made to the manuscript.

We thank the reviewer for their comment. If a paper is only presented at a congress, then the experience would only be shared with attendees. We believe that publishing this in a journal that is of interest to thoracic surgeons aids in the dissemination of science and advancement of the technical, operative aspect of our field. We have changed the title of the paper. We acknowledge the limited nature of our case series.

We would ask the reviewer to please refer to Reply A.1 and Reply A.3 because we believe we illustrate that there is a lack of literature and utilization regarding the robot as a good modality for chest wall resection along with our reasons why we think it is an excellent platform for this surgery.

Reviewer D

Impression: “When we analyze lines number 69 and 70 of the article, the total number of patients operated by robotic surgery for chest wall tumors, both for the service that presents the 6 cases and the database of 96 cases for comparison; We did not observe the total number of cases with malignant diseases of the thoracic wall operated on both references. A general description of the number of cases operated and the different access routes would be interesting, showing the space for robotic surgery.”

Reply: We thank the reviewer for their thoughtful commentary. All patients in the NCDB (n=96) had malignant primary lung tumor which invaded the chest wall with 92 patients having either adenocarcinoma or squamous cell carcinoma histology and 4

patients having a malignant neuroendocrine histology. We will also specifically state there were 3 benign and 3 malignant tumors in our institutional series. The histology of the tumors in our institutional series are also specifically reported in Table 2.

Please refer to Reply A.2 for a detailed description of our methodology for port placement which we have included in the revision of the manuscript.

The following changes have been made in the manuscript:
[Results, 1st paragraph]: Final pathology demonstrated 3 patients had benign primary chest wall tumors, and 3 patients had locally advanced lung cancer invading the chest wall. The operative and pathological details are highlighted in Table 2.

[Results, 3rd paragraph]: All patients had primary lung cancer invading the chest wall and underwent en-bloc lung and chest wall resection. Of these patients, 92 (95.8%) had adenocarcinoma or squamous cell carcinoma while 4 (4.2%) had malignant neuroendocrine histology.

Comment D.1: “Lines 79 to 82 show the analysis period of cases over time; but a divergence between these timelines. Service data compared from 2016 to 2021 and NCDB data from 2012 to 2017. Our suggestion is that this data be uniform over time.”

Reply D.1: We would like to thank the reviewer for their thoughtful comments. While we do note the time discrepancy between our institutional series and the NCDB data, we believe that the timeline difference does not negatively impact our conclusions. Mainly, in our institutional case series, we seek to describe our operative technique and demonstration of excellent functional outcomes. We included the NCDB data to illustrate a growing adoption of using the robotic platform for chest wall resections in the US and to serve as a foil to compare to our institutional outcomes. Additionally, patients in our institutional series had operations performed using both the Intuitive Surgical Da Vinci Si and Xi robotic surgical platforms. Given the use of both platforms we feel that the comparison to earlier NCDB data is appropriate as our outcomes were not solely based on the newer Xi platform only. Additionally, the NCDB only has data up to 2017 by design because it is a database used to study patterns of treatment and effects on overall survival. We adopted robotic technology in 2016; we did not have it prior. The paper is descriptive and emphasizes the trends of use.

Comment D.2: “An important detail is the concept of chest wall resection; there was removal of the entire thickness of the wall, reconstruction of the wall with or without a flap, as well as location of the thoracic cavity; these details change from technique to prognosis. Demonstrations like these make our learning and knowledge transfer possible. The care at this point is that cases with different etiologies and anatomical locations were shown, that in a general analysis the degrees of technical difficulty and access routes change a lot, even in Robotics. Suggestion: draw up a graph with both samples and figures that demonstrate the access technique with Robotics with some

learned tricks."

Reply D.2: We thank the reviewer for their thoughtful comments. We agree that approaches for minimally invasive thoracic surgery can vary. However, our institution utilizes the same port placement for every case except if the location of rib resection falls where our usual port placement lies. In the situation where the resection margin lies within the usual site for port placement, we chose a new port site based on the specific triangulation needs for the case which is at the surgeon's own expertise.

We agree with the reviewer. The purpose of the study is to write a descriptive series of robotic chest wall resection and enrich it with a national data set.

The following changes have been made in the manuscript:
[Methods, Operative Technique]: The patient is placed in the lateral decubitus position. Our preferred port placement consists of 4 robotic ports (three 8 mm ports and one 12 mm port) all in line in the 8th intercostal space. However, we are flexible with port placement to optimize triangulation to the lesion after the insertion of the first camera port to allow triangulation to tumor. We opt for the four in line ports because we believe when a lung resection is necessary the hilar dissection is the most important part of the operation. The chest wall portion is performed at the end after the hilar dissection is completed.

Reviewer E

Impression: "Up today robotic assisted chest wall resection is not considered a "standard" technique. However, being minimally invasive also during "invasive" surgery, is reported to be advantageous with several reports in literature mainly about VATS assisted chest wall resections. The authors reported a large series from their institutional experience and from the National Cancer Database. Eventually, I find the topic interesting; however, I have several doubts on how you settled your research."

Reply: We would like to thank the reviewer for taking the time to review our manuscript and offer suggestions for improvement.
Comment E.1: "You considered two very different group of patients. The first (n=4 cases, all form your personal series) affected by primary chest wall lesions. The second one (98 cases) affected by a primary lung cancer invading the chest wall. This is confusing. They are two very different pathologies. Primary chest wall tumors need wide resections, involving not only bone and cartilages but also soft tissues. They also need rigid (titanium) and not rigid (mash, muscle flaps), often together. The message that this kind of surgery can be done safely by RATS cannot be accepted. Actually, you report 4 cases of primary lesions which are not usually considered in the group of malignant chest wall lesions (like Chondrosarcoma, Ewing Sarcoma, Osteosarcoma, other soft tissues sarcomas and so on). So, in my opinion you used RATS for chest wall benign lesions. You should exclude these cases and re-write the paper using just primary

lung cancer cases. Alternatively, exclude malignant lesions and do the contrary."

Reply E.1: We thank the reviewer for their discerning critique. We did not resect any primary malignant chest wall lesions in our institutional series we agree. Three patients had a diagnosis of benign primary chest wall tumor, and three patients had a malignant primary lung tumor invading the chest wall. The NCDB series data were all primary malignant lung tumors invading the chest wall. We have not yet resected any primary malignant chest wall tumors at our institution, but we do not see how this changes our conclusions.

The following changes have been made to the manuscript:
[Discussion, 8th paragraph]: However, in this series we did not resect any primary malignant chest wall tumors so we cannot comment on using our technique for a primary chest wall malignancy. We believe if sound oncologic surgical principles are followed, then it is certainly possible to resect malignant chest wall tumors robotically.

Comment E.2: "Lung resections en-bloc with the chest wall have very different post-op outcomes and complication rate from isolated chest wall resection of benign lesions."

Reply E.2: We thank the reviewer for their thoughtful comment. While we understand en-bloc lung resections with the chest wall differ in morbidity from isolated benign chest wall lesions, we decided to include these two case types together to have a larger institutional case series. We felt that our outcomes reported in the individual case descriptions demonstrate the feasibility of the robotic approach for both disease processes.

Comment E.3: "Indication to surgery in chest wall lesions should be evaluated after biopsy; this is a widely accepted policy since the extent of chest wall resection must be planned. You never mentioned this step; I wonder if you usually resect benign and malignant lesions in the same way? Do you never evaluate the need of induction therapy in case of malignant lesion? Please, comment on this."

Reply E.3: We thank the reviewer for their thoughtful commentary. In general, primary chest wall lesions at our institution with completely benign radiographic features measuring less than 4 cm would be referred for an excisional biopsy. Benign-appearing tumors greater than 4 cm or any tumor with concerning radiographic findings would be referred for a radiographic biopsy to ascertain a diagnosis and to assess if the lesion is benign or malignant.

We discuss in detail the workup of the patients for your clarification.

Case 1: 68F with a known history of fibrous dysplasia diagnosed in her thirties with lesions involving her cervical spine, skull, and ribs. She had a biopsy of her rib lesions

approximately 6 months prior to her presentation to us at an outside hospital which showed fibrous dysplasia. The patient presented for surgical resection due to significant pain from her rib lesions. Her lesions involving the spine and skull were stable on imaging, but the tenth rib lesion demonstrated interval growth from prior scans. Due to the patient's increasing pain from the lesions in addition to the large size of the third rib lesion (7.7 cm in largest dimension) and changing size of the tenth rib lesion, the decision was made to proceed to the operating room for surgical resection of the symptomatic lesions and also to confirm the benign pathology of the lesions.

Case 2: 69M smoker who was having CT scan for lung cancer screening found to have incidental chest wall mass in the posterior fourth intercostal space measuring 5.6 cm in largest dimension on CT that was asymptomatic. Patient was reviewed in thoracic oncology tumor board by medical oncology, thoracic surgery, pulmonary, and nuclear medicine. PET CT scan recommended and demonstrated the FDG avid to 4.5 SUV but no FDG avid lymph nodes or other lung nodules. The lesion also did not appear to be destroying the bone. Thoracic oncology tumor board recommended an IR biopsy of the mass. Both interventional radiology and musculoskeletal interventionalists were consulted. Both interventionalists, upon discussion with thoracic tumor board, felt that the location of the tumor in the posterior chest wall anterior to the scapula was a technically challenging location and had close association with the thoracoacromial artery and its branches and would be hard to biopsy. The thoracic oncology tumor board decided the best plan was to move forward with surgical excision, and the patient was agreeable to this plan as well.

Case 3: 39M who presented with pleuritic chest pain found to have a tumor of the fourth rib that measured 2.3x0.8x0.4 cm and subsequently underwent biopsy of the lesion which revealed Langerhans cell histiocytosis. The patient was discussed in thoracic oncology tumor board where he was deemed a suitable candidate for resection. Pleural fluid was sent for cytology in the operating room as well which was additionally negative for malignancy.

Case 4: 88M with new onset radiation shoulder pain for six weeks. Complete workup demonstrated an infiltrating chest wall lesion FDG avid on PET CT to 13.5 SUV. No evidence of mediastinal or nodal disease and PFTs were excellent for lobectomy. Biopsy of a prominent level 4 lymph node was done which was negative for malignancy. Patient discussed in tumor board and determined that surgical resection was appropriate. Frozen sections were sent on the lesion in the OR which demonstrated infiltrating squamous cell carcinoma to chest wall.

Case 5: 73M who presented to our institution with a known diagnosis of non-small cell lung cancer that was infiltrating into his chest wall causing persistent pain. No positive lymph nodes noted on PET CT and patient had persistent pain from the tumor. Patient had excellent PFTs and was determined to be a candidate for surgical resection.

Case 6: 67F with biopsy proven cT3N2 squamous cell lung cancer invading her chest wall presented after neoadjuvant therapy completion and thoracic tumor board deemed she was appropriate for resection.

The following changes have been made to the manuscript:
[Methods, Operative Technique]: In general at our institution tumors smaller than 4 cm with benign imaging characteristics proceed for excisional biopsy. Tumors greater than 4 cm or tumors with any concerning features on cross-sectional imaging will undergo biopsy of the lesion to establish a diagnosis for surgical planning.

[Results, Case 1]: A 68-year-old female with a history of renal cell carcinoma (post left partial nephrectomy status) and polyostotic fibrous dysplasia (ribs, spine, and skull) presented with right lower chest wall pain. A biopsy performed of the rib lesion six months prior at another hospital demonstrated polycystic fibrous dysplasia.

[Results, Case 2]: A 69-year-old male with a history of hyperlipidemia and tobacco use presented to us after screening CT scan for lung cancer discovered an incidental chest wall mass in the right posterior fourth rib interspace measuring 3.1x2.5x2.6 cm. Lesion was avid to 4.5 SUV on PET CT with no other positive lymph nodes or lung lesions. Patient discussed in tumor board and referred for biopsy but was deemed to not be technically feasible due to location anterior to scapula. Therefore, we proceeded for surgical excision.

[Results, Case 3]: A 39-year-old male with a history of morbid obesity presented with chest wall pain. A chest CT showed a left fourth rib lesion measuring 4.5x2.2x2.8 cm behind the scapula. Biopsy of lesion demonstrated Langerhans cell histiocytosis. The patient was discussed in tumor board and deemed appropriate for surgical resection.

[Results, Case 4]: A chest CT showed left second and third rib involvement by a mass arising from the lung parenchyma measuring 3.1x3.3x3.4 cm (Fig. 2). On PET CT mass SUV 13.5 with no other avid lesions. A prominent AP window lymph node was biopsied and negative for malignancy. Patient discussed in thoracic oncology tumor board and deemed appropriate to proceed for resection.

[Results, Case 5]: A 73-year-old male with a history of diabetes, hypertension, and chronic obstructive pulmonary disease (COPD) was referred to our clinic for management of biopsy proven non-small cell carcinoma of the lung infiltrating the chest wall causing persistent pain. CT showed pleural-based paraspinal lung lesions measuring 3.7x1.7 cm. After a complete workup the patient was deemed a suitable candidate for resection.

Comment E.4: “For the reasons above mentioned, evaluating post-op results all together (benign tumors and lung cancers) has no sense.”

Reply E.4: We thank the reviewer for their thoughtful comment. Our aim of this publication was first to describe our institutional technique for chest wall resection utilizing the robot in order to publish what we believe is the largest case series on the subject that is not reporting results and approaches for robotic first rib resection. We have individually written each case description out in the Results section as well as the specific patient characteristics and outcomes. We believe that this level of individual granular detail provides the reader with the information necessary to differentiate the subtleties between cases.

Comment E.5: "You never mentioned chest wall reconstruction, even in your personal series. Among these 6 cases, you resected 2 ribs in 4 patients. How did you reconstruct the chest wall?"

Reply E.5: We thank the reviewer for their thoughtful comments. We indicated in the Operative Technique section of the Methods that by dissecting the ribs from the chest wall musculature intrathoracically we are able to leave the chest wall musculature intact which provides adequate coverage and strength to prevent lung herniation. This obviates the need for a traditional reconstruction method. Therefore, none of the six patients in our institutional series received a traditional chest wall reconstruction. We have included CT scan data where available to add to the follow up data to report on lung herniation and physical exam findings regarding chest wall motion. Five patients had available data.

The following changes have been made to the manuscript:

[Methods, 2nd paragraph]: The follow-up information included adjuvant/neo-adjuvant therapies used, length of hospital stays, complications, evidence of lung parenchyma herniation, paradoxical chest wall motion, and follow-up periods.

[Results, Case 1]: No paradoxical chest wall motion on exam three months post-surgery. CT scan 12 months post-surgery demonstrated no herniation of lung tissue.

[Results, Case 2]: CT chest 2 years post-surgery demonstrates no herniation of lung tissue. Physical exam 2 years post-surgery without evidence of paradoxical chest wall motion.

[Results, Case 3]: CT scan 26 months post-surgery demonstrated no herniation of lung tissue. Patient alive and well with physical exam at 31 months post-surgery without paradoxical chest wall motion.

[Results, Case 4]: CT scan 4 years post-surgery without lung tissue herniation. Exam at 4 years without paradoxical chest wall motion.

[Results, Case 5]: At 42 months post-surgery the patient had no evidence of paradoxical chest wall motion on physical exam and had a CT scan demonstrating no lung tissue herniation and no evidence of recurrent disease in chest wall or lung parenchyma.

Comment E.6: "Polyostotic fibrous dysplasia (case 2) has a high rate of local recurrence and needs wide excision; it means one rib of safety margin (over and under), whenever possible. It looks like you resected just the macroscopically affected bones. This is not acceptable."

Reply E.6: We thank the reviewer for their thoughtful comment. We respectfully disagree with the reviewer. This is a benign condition and, generally speaking, small fibrous lesions do not need to be resected unless they are symptomatic. The condition is not limited to one region of the body, and commonly multiple bones are involved. Lastly, this is a benign condition and as such resection with extensive margins is not indicated.

Comment E.7: "In case you report primary chest wall tumor resections, the radically should be reported not only using R0-1-2, but also using the Enneking classification of surgical margins (this is valid for case 2 in your series)."

Reply E.7: We thank the reviewer for their thoughtful commentary. We do not use the Enneking classification. Additionally, all three patients with primary chest wall tumors had benign histology, and we do not report margins for benign disease.

Comment E.8: "RATS for chest wall resections is reported mainly in TOS (first rib resection). Reading the title, you should give a clear message that your series included only tumors."

Reply E.8: We thank the reviewer for their input. We agree with the reviewer and have changed the title of the paper to "Robotic Chest Wall Resection for Primary Benign Chest Wall Tumors and Locally Advanced Lung Cancer: An Institutional Case Series and National Report."

Reviewer F

Impression: "I enjoyed the manuscript by you Dr Verm and your colleagues from Loyola University of your RA-CWR cases and a national review of RA-CWRs from the NCDB; 6 cases at their institution. I have a few comments and several ?s: All of CWRs were performed without CW reconstruction, which was more likely related to location (covered by scapula and only 1 or 2 ribs removed, but was surprising for an after tumor size of 11.5 cm."

Reply: We thank the reviewer for their time in reviewing our manuscript. We have

addressed the issue of tumor size in a prior comment. Please see Reply A.4 for detailed changes made to the manuscript.

Comment F.1: “What percentage of the NCDB patients had CWRecon? For only six cases your follow up needs to focus also on the chest wall such as paradoxical motion and possible lung herniation (LH).”

Reply F.1: We thank the reviewer for their thoughtful Reply. The NCDB unfortunately does not provide enough granular detail to determine how many patients in the series received a chest wall reconstruction. We describe in our Operative Technique section of the Methods that with our technique of dissecting the ribs from their musculature intrathoracically we are able to retain the integrity of the overlying muscles which provides adequate coverage and strength to the chest wall, preventing lung herniation. We have reviewed the patient charts and found that none of the patents with available CT scans and physical exam data reported in the chart (five out of the six patients) had any evidence of lung herniation through the chest wall defect or any paradoxical chest wall motion.

Please see Reply E.5 for the details regarding this follow up data and changes made to manuscript.

Comment F.2: “Was there any evidence of LH on follow-up CT Scans? Added postop CT Scan would strength the manuscript, especially patients greater than 12 months.”

Reply F.2: We thank the reviewer for their thoughtful comment. We have included long-term follow-up CT scan data where available. Of available CT scan data in 5 of 6 patients we had no evidence of herniation of lung tissue through the chest wall as far out as four years post-surgery. Please see Reply E.5 for detailed changes to the manuscript.

Comment F.3: “What were the margins of your CWRs - not include in Table 2. Also, need to add images or schematic drawing of your incisions especially when using the Gigli saw.”

Reply F.3: We thank the reviewer for their thoughtful commentary. Of our institutional series (n=6), three patients had a diagnosis of a benign primary chest wall tumor, and we do not obtain margins on benign tumors. The other three patients had a diagnosis of a primary lung malignancy that invaded the chest wall. We adhere to the current standard of care that grossly no tumor on the cut edge of bone is an adequate margin for this disease process.

We have included a video of our operative technique that will serve as a guide to how the Gigli saw rib shearing methods is employed.

Comment F.4: “A video of the Veran EMS/MM blue technique and the CWR would be great as this is a technique's manuscript.”

Reply F.4: We thank the reviewer for their thoughtful comment. We have included a video of this technique in our revision.

We have made the following changes to the manuscript:
[Methods, Operative Technique]: See Video 1 for a demonstration of our operative techniques taken from Case 3 in this series.

Comment F.5: “Need to add your guidelines of work-up and determination of which patients are or are not a candidate for RA-CWR.”

Reply F.5: Thank you for the thoughtful comment. The robotic technique was chosen because we believe robotic chest wall resection can be widely applicable to many chest wall tumors. At our institution, a robotic approach is the preferred approach for surgeons and is used for all cases to start. Tumors that involve major vascular structures, the sternum, or are over 10 cm in largest dimension are excluded from a robotic approach. Additionally, we exclude resections that are known preoperatively to require a chest wall reconstruction from a robotic chest wall resection.

Please see Reply A.1 for detailed changes to the manuscript.

Reviewer G

Impression: “This is an interesting topic and there aren´t a lot of literature regarding Robotic chest wall resection. The article is well written but I have some questions about it:”

Reply: We would like to thank the reviewer for their thoughts and commentary on our manuscript.

Comment G.1: “It would be useful a short video or more visual imaging regarding operative technique. The most interesting topic is the technical feature and in my opinion it isn´t very clear in the methods.”

Reply G.1: We would like to thank the reviewer for their kind commentary. We have a video demonstrating our operative technique and we will submit it for publication with our revision.

We have made the following changes to the manuscript:
[Methods, Operative Technique]: See Video 1 for a demonstration of our operative techniques taken from Case 3 in this series.

Comment G.2: “I would summarize all patients’ data in a table and not show every single patient such as a case report. I find the list of the patient not interesting and not useful.”

Reply G.2: We thank the reviewer for their thoughtful commentary. We have received comments from other reviewers that comparing benign chest wall resections to en-bloc lung and chest wall resections are not comparable. We believe reporting the individual patient data in the tables allows the reader more granular data to discern the differences between each case for a more nuanced perspective of what we accomplished in our institutional case series