AN EXPERIENCE OF CORRECTIVE SURGERY OF 37 CASES OF CHEST DEFORMITY

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ABSTRACT

Objectives: The study was carried out to ascertain the cosmetic outcome of corrective surgery for pectus deformity and to determine the morbidity associated with it.

Study Design: Quasi-experimental study.

Place and Duration of Study: The study was conducted in CMH Rawalpindi and CMH Quetta from 2007 to 2012.

Methodology: Total number of cases operated for chest deformity was 37. Modified Welch procedure with sub perichondrial resection was done with a strut of prolene mesh in a majority of excavatum repairs and k wires in few. Pectoroplasty was subsequently carried out in all patients. Midline incision was made in a majority of patients. Submammary incision was made in some female patients with a lower deformity due to better cosmetic outcome. Inclusion criterion was patients with chest deformity without any cardiac and spinal deformity.

Results: Age range was between 4 years to 12 years with mean age of 8 ± 2.3 years. Twenty four (65%) deformities were of excavatum and 9 (24%) were of carinatum type. Four (11%) cases were of unilateral asymmetrical deformity. Mean operating time was 95 ± 11 minutes. Transfusion was required in only 1 (3%) of the cases. There was no perioperative mortality. Four (11%) patients had formation of seroma and 3 (8%) developed pneumothorax which was aspirated without placement of chest tube. Two (5%) had surgical site infection. Fifteen (41%) patients were satisfied and 21 (57%) reported excellent results.

Conclusion: Chest deformity correction is safe and effective procedure with acceptable cosmetic results. It is easy to perform and improves self image of the suffering individual.

Keywords: Pectus excavatum, Pectus carinatum, Welch procedure osteotomy.

INTRODUCTION

Pectus excavatum (PE) is the most common chest deformity present in up to 1:400 live births with a male to female ratio of 4:1[1]. It is followed by pectus carinatum (PC). PE is characterized by inwards depression of anterior chest and majority of patients are recognized during the infancy. The depression usually becomes more severe during the period of rapid skeletal growth in early adolescence. On the other hand, PC is often diagnosed in late childhood when adolescent skeletal growth ensues[2]. Majority of patients with chest deformities are asymptomatic. Symptoms may range from mild pain and exercise intolerance to manifestations of cardiac and respiratory compromise. The commonest indication for corrective surgery is cosmetic[3]. Different theories have been described related to pathogenesis of chest deformity.

The technique described by Ravitch in 1949 underwent several modifications including the one described by Welch in 1958. Nuss proposed a minimally invasive technique of repair of PE by insertion of metal bars in 1998. The procedure was later modified by Nuss himself and Park in 2010[4].

The Modified Welch Procedure includes subpericondrial resection of all deformed cartilages, wedge osteotomy of sternum, placement of sub-sternal strut, xiphostenopexy and pectoroplasty[5]. Potential complications include haemorrhage from internal mammary vessels, cardiac injury, pneumothorax, pleural effusion, seroma formation, wound dehiscence, paradoxical breathing, wound infection and pulmonary complications[6]. Satisfactory post operative results can be achieved in a majority of patients by meticulous technique.

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The purpose of our study was to identify the cosmetic results of corrective surgery of both pectus excavatum and carinatum carried out at our set up exclusively by modified Welch technique. We recorded cosmetic improvement of the deformity and studied the frequency of complications in these patients.

MATERIAL AND METHODS

It was a quasi-experimental study carried out on patients undergoing surgical correction of chest deformity at Combined Military Hospital Quetta (2007-2009) and Rawalpindi (2009-2012) by same surgical team. 37 consecutively operated patients were included in the study. Patients of all ages reporting with chest deformities, keen for repair of the deformity and not having associated metabolic or cardiac abnormalities were included in the study.

Data regarding age, gender, type of deformity, chest radiographs in postero-anterior and lateral views were recorded on a proforma. Serum calcium and Vitamin D3 levels were carried out in all patients to rule out metabolic abnormalities. Echocardiography was done to exclude structural cardiac abnormalities. Spinal deformities were excluded by radiographs of dorsal and lumbar spine.

Informed written consent was taken by patients regarding study as well as surgical procedure. All patients were operated by Modified Welch procedure under general anaesthesia (GA). In supine position a midline sternal incision was used in majority except 4 female patients with a lower deformity only where sub mammary incision was used. Sub-perichondrial resection of all deformed cartilages was done. Sternal wedge osteotomy was done followed by placement of prolene strut in all patients of pectus excavatum except 3 where K wires were used. Xipho rectopexy was done in all patients. It was followed by pectoroplasty. A vacuum drain was placed in all patients which was removed on 3rd or 4th post operative day.

Intra operative and early post operative complications were recorded. Post operative haemoglobin and chest radiograph was done. After discharge, the patients were followed up for up to one year. Opinion of patients and/or parents was taken and recorded regarding their satisfaction on cosmetic outcome. It was graded as unsatisfactory, satisfactory and excellent.

Data analysis was carried out through SPSS. Quantitative data was subjected to calculation of mean and standard deviation while qualitative data was analysed through calculation of frequencies and percentages.

RESULTS

Total number of cases operated for chest deformity was 37. Age range was between 4 years to 12 years with mean age of 8 ± 2.3 years. 28 (76%) patients were male and 9 (24%) female. 24 (65%) deformities were of excavatum and 9 (24%) were of carinatum type. 4 (11%) cases were of unilateral asymmetrical deformity.

Out of 37 patients, 13 (35%) were totally asymptomatic. The most common associated symptoms among the rest of the population were shortness of breath (table).

Modified Welch procedure with sub perichondrial resection was done. Out of 24 patients with pectus excavatum, a strut of prolene mesh was placed in 21 (87%) patients and k wires in 3 (13%). Pectoroplasty was subsequently carried out in all patients as shown in fig-1. Midline sternal incision was made in 33 (89%) patients and submammary incision in 4 (11%) patients, all females with low deformities. Mean operating time was 95 ± 11 minutes, ranging from 80 to 130 minutes. Transfusion was required in only one (3%) of the cases. There was no perioperative mortality. Mean duration of hospital stay was 3.5 ± 0.6 days, with a range from 2 to 6 days post operatively. Two (5%) patients had superficial surgical site infection, 4 (11%) patients had formation of seroma and 3 (8%) developed pneumothorax recognized per operatively which was aspirated without placement of chest tube. No patients had damage to internal mammary vessels or heart. One patient (3%) developed atelactasis and pleural

effusion on left side which resolved with conservative management. There was no incidence of paradoxical chest wall movement post operatively (figure 1,2).

During follow up visits, only one (3%) patient`s parents did not seem to be satisfied by the cosmetic outcome of repair. Fifteen (41%) patients were satisfied and 21 (57%) reported excellent results. Post operative pain was manageable in all patients with non steroidal anti inflammatory drugs, injectable while indoors and oral after discharge from hospital. No patient required opioid analgesia.

DISCUSSION

In minimally invasive surgery, the technique described in 1998 by Donald Nuss has gained popularity[13,14]. In Nuss procedure, a Lorenz pectus bar is used which is a thin long and curved metal sheet. A small incision is made laterally and the bar is then gently inserted posterior to the anterior chest wall, thus reaching the opposite lateral wall[15]. Great caution has to be exercised to avoid damage to the heart. Now this bar is rotated to reverse the PE deformity mechanically by lifting the anterior chest wall anteriorly. It is however associated with significant post operative pain compared to open procedures[16].

Prolene mesh, marlex mesh, steel bars have all been used to keep the sternum in corrected position in surgery of pectus deformities. We had a preference for prolene mesh due to ease of its use and availability[17].

Our patient population consisted of toddlers, children and young adolescents with a maximum age of 12 years. As consistent with literature on the subject, a significant percentage (35%) were asymptomatic. Rest had only mild shortness of breath on exertion and mild precordial pain. Only 2 (5%) patients reported palpitations with no positive findings on ECG or echocardiography. Data regarding symptoms is depicted in table-1.

In our study we employed a modified Welch procedure. A prolene mesh strut was placed posterior to the sternum to keep it elevated in PE. Pectoroplasty was done in all patients. Out of

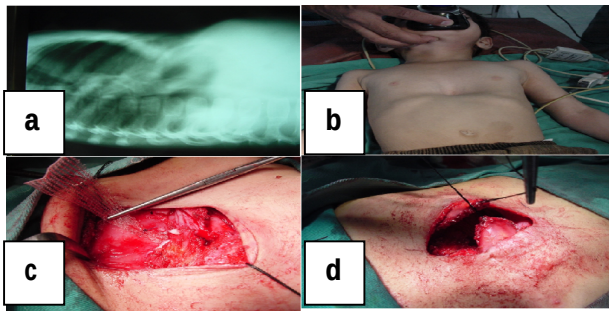

Figure-1: Pectus excavatum (a) Pre op lateral radiograph (b) Anterior view on operating table (c) Prolene mesh strut in place (d) Pectoroplasty.

Figure- 2: Pectus Carinatum before (Left) and after surgery (Right).

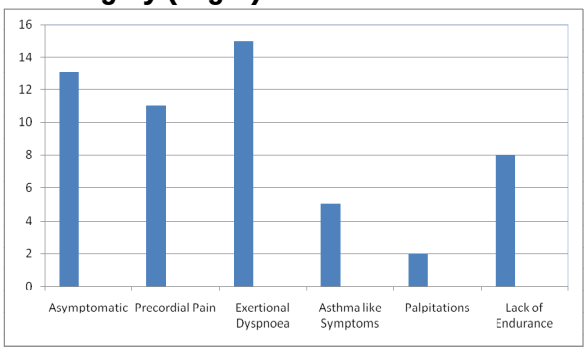

Table: Breakdown of symptoms associated with chest deformity.

seven costal cartilages which are attached directly to sternum, at least four were resected in all. In the beginning the operative time was much longer but it reduced to less than 90 minutes in the last few cases.

In our study, we had no peri operative mortality or major complication. Pnuemothorax identified during surgery was aspirated by a

nasogastric tube in 3(8%) patients prior to wound closure. In 1(3%) patient mild pneumothorax was noted post operatively which was managed expectantly. Superficial surgical site infection occurred in two patients despite use of per operative fourth generation cephalosporin and post operative antibiotic cover. Seroma formation in few cases was managed by repeated aspirations. The overall peri operative complication profile was comparable to a study published by an eminent surgeon like Fonkalsrud. There is however a study published by Lorenzo GR et al which reports zero percent intra operative complications.

We consider the overall cosmetic outcome of our study population fairly satisfactory. Only one patient (3%) reported lack of satisfaction over the cosmetic outcome. Rest all reported satisfactory to excellent results. This is also comparable to various studies carried out at centres where high volume of pectus surgery is being done. We consider that post operative pain control was satisfactory in our study population. No patient required opioid analgesia as compared to a significant proportion of patients undergoing minimally invasive Nuss technique as described by different studies such as one by Grosen K et al in 2010[3]. However Nasr et al reported similar incidence of pain in minimally invasive and open techniques[16].

CONCLUSION

With various surgical techniques available, Modified Welch procedure is a safe option with minimum morbidity, reasonable operating time and good cosmetic outcome. Pectus deformities are not very uncommon. These deformities may be associated with psychosocial abnormalities and poor self image. Severe deformities are more commonly associated with cardiac, respiratory, spinal or metabolic abnormalities which all need to be ruled out prior to intervention. We recommend that surgical repair of the deformities should be performed at an early age even in asymptomatic patients because of the progressive nature of the disease.

REFERENCES

1. Fonkalsrud EW. Open Repair of Pectus Excavatum With Minimal Cartilage Resection. Ann Surg. 2004 August; 240(2): 231–235.
2. Fonkalsrud EW, DeUgarte D, Choi E. Repair of Pectus Excavatum and Carinatum Deformities in 116 Adults. Ann Surg. 2002 September; 236(3): 304–314.
3. Grosen K, Pfeiffer-Jensen M et al. Postoperative consumption of opioid analgesics following correction of pectus excavatum is influenced by pectus severity: a single-centre study of 236 patients undergoing minimally invasive correction of pectus excavatum. Eur J Cardiothorac Surg. 2010; 37 (4): 833-9.
4. Park HJ, Jeong JY, Jo WM, Shin JS, Lee IS, Kim KT, Choi YH. Minimally invasive repair of pectus excavatum: a novel morphology-tailored, patient-specific approach. J Thorac Cardiovasc Surg. 2010 Feb;139(2):379-86.
5. Lorenzo GR, Gutiérrez Dueñas JM, et al. Preliminary results in the correction of the pectus excavatum with the Acastello modified Welch technique. 2011;Cir Pediatr 24 (4): 201-7.
6. Zganjer M, Cigit I et al. A 3-year experience of a minimally invasive technique for correction of pectus excavatum in Croatia.2005; Coll Antropol 29 (1): 107-9.
7. Eguchi T, Sasaki S, Hara F, Kondo S, Masaoka A. Natural course of thoracic deformity in pectus excavatum. Shonika 1993;34:61-65. (In Japanese)
8. Kelly RE Jr. Pectus excavatum: historical background, clinical picture, preoperative evaluation and criteria for operation. Semin Pediatr Surg. 2008 Aug;17(3):181-93.
9. Brown AL. Pectus excavatum (funnel chest) anatomic basis; surgical treatment of theincipient stage in infancy; and correction of the deformity in the fully developed stage. J Thorac Surg. 1939;9:164-184.
10. Ravitch MM. The Operative Treatment of Pectus Excavatum. Ann Surg. 1949 Apr;129(4):429-44.
11. Ravitch MM. Technical problems in the operative correction of pectus excavatum. Ann Surg. 1965 Jul;162:29-33.
12. Welch KJ. Satisfactory surgical correction of pectus excavatum deformity in childhood; a limited opportunity. 1958; J Thorac Surg 36 (5): 697-713
13. Nuss D, Kelly RE Jr, Croitoru DP, Katz ME. A 10-year review of a minimally invasive technique for the correction of pectus excavatum. J Pediatr Surg 1998 Apr;33(4):545-52.
14. Nuss D. Recent experiences with minimally invasive pectus excavatum repair "Nussprocedure". Jpn J Thorac Cardiovasc Surg. 2005 Jul;53(7):338-44.
15. Nuss D. Minimally invasive surgical repair of pectus excavatum. Semin Pediatr Surg. 2008. Aug;17(3):209-17.
16. Nasr A, Fecteau A, Wales PW. Comparison of the Nuss and the Ravitch procedure for pectus excavatum repair: a meta-analysis. J Pediatr Surg. 2010 May;45(5):880-6.
17. Mansour KA, Thourani VH, Odessey, EA, Durham MM, Miller, JI, Miller DL. Thirty-year experience with repair of pectus deformities in adults. Ann Thorac Surg 2003;76:391-395.