Transthoracic Patent Ductus Arteriosus Ligation Without Chest Drain Insertion

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Objective: To study safety of doing Transthoracic, Patent Ductus Arteriosus Ligation without chest tube insertion. **Study Design:** Observational, Prospective, Descriptive. **Place and Duration**: Department of Cardiothoracic Surgery, Postgraduate Medical Institute, Lady Reading Hospital from June2002 to June 2004. **Material and methods:** This prospective study was done to study the results of this selective approach in forty five (45) patients operated by transthoracic approach between June 2002 and June 2004 for patent ductus arteriosus ligation. There were 27 females and 18 males, ranging in age from 06 months to 07 years (mean: 2.3 years) and a weight of 6.0 kg to 22.1 kg (mean 11.3 kg). Patients < 07 years, with no pulmonary pathology, no peroperative pulmonary adhesion, no per operative ruptured ductus arteriosus and with good lung expansion prior to the chest closure were included in this study. Patient more than 07 years of age, with extreme adhesion and those whose patent ductus arteriosus ruptured during dissection were excluded from this study. Parents of the patients were informed about potential risks of this selective approach. Only those patients whose parents had given adequate; informed consent were eligible for this study. **Results:** There was no mortality. No drain related morbidity like pneumothorax, haemothorax or chylothorax occurred. Postoperatively children had less analgesia, earlier feeds and mobilization. Mothers were not apprehensive about holding or feeding the baby. Consequently there was earlier discharge to home. In addition these children had a more cosmetic scar, and no drain related problems. **Conclusion:** A selective approach to the use of chest tube in Transthoracic approach for patent ductus arteriosus can be safe, cost effective and patient friendly.

Key Words: Transthoracic, Patent Ductus arteriosus ligation, chest drain insertion

Patent ductus arteriosus (ductus of Botalli) is an abnormality that results from persistence of the fetal ductus arteriosus in the postnatal period. It can be recognized in a variety of circumstances. Most often a patent ductus arteriosus presents is a simple shunt between the systemic arterial to pulmonary arterial circulation. Commonest presentations are recurrent chest infection and at times cardiac failure. The closure of a patent ductus arteriosus was first attempted by Strider in 1937; unfortunately the patient died of postoperative complications. A year later, the first successful closure was performed by Gross and Hubbard[1,2]. Further innovations in the treatment of congenital heart disease also revolutionized closure of the patent ductus arteriosus. An important innovation included, the understanding of the role of prostaglandins in ductal patency and the use of inhibitors of PGE1 synthesis to induce closure[3]. However, premature babies and small infants with a large patent ductus arteriosus are still treated by either occlusion or ligation.

Most patients with a patent ductus arteriosus are treated by transcatheter Coil occlusion[4]. In addition technique for video assisted thoracoscopic ductus closure is a safe and reliable technique and can be performed as an outpatient[5]. Recently dorsal minithoracotomy for ductus arteriosus clip closure in premature neonates has also been reported [6]. However in our circumstances the transcatheter coil occlusion of patent ductus arteriosus is in its infancy because of the cost involved and lack of expertise. Vide assisted thoracoscopic equipment is also not available.

We in our unit have been doing transthoracic ligation of patent ductus arteriosus since 1989 with insertion of chest drains. The babies were in distress as they had fear of chest drains and needed higher doses of analgesia. Mothers were also hesitant to handle babies with chest drains and feeding plus mobilization would be delayed. Initially we used to take drain out after 48 hours; in view of the afore mentioned problems we cut that time to 24 hours initially and then started removing them the same evening after chest x-ray. This led us to conduct this prospective study to try and do away with the chest drain altogether, in a selected group of patients with controlled postoperative environment.

Material and methods

This prospective study was done to study the results of this selective approach in forty five (45) patients operated by transthoracic approach between June 2002 and June 2004 for patent ductus arteriosus ligation. There were 27 females and 18 males, ranging in age from 06 months to 07 years (mean: 2.3 years) and a weight of 6.0 kg to 22.1 kg (mean 11.3 kg). Patients < 07 years with no pulmonary pathology, no peroperative pulmonary adhesion, no per operative ruptured ductus arteriosus and with good lung expansion prior to the chest closure were included in this study.

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selective approach. Only those patients who parents had given adequate; informed consent were eligible for this study.

All patients had preoperative routine investigations, plus chest x-ray and echocardiography and were assessed by anesthetist. General anesthesia was induced using midazolam. Relaxation of the patient with pancuronium was followed by tracheal intubation. Anesthesia was further managed by inhalation of isoflurane. During the procedure continuous pulse oximetry and heart rate was maintained and both lungs were ventilated with low tidal volume, as we have no double lumen endotracheal tube available for children. Prior to ligation of patent ductus arteriosus the blood pressure was lowered by increasing Isoflurane or starting intravenous nitrates.

In all cases surgical access was made through left posterolateral thoracotomy via third intercostal space. Double ligation of the patent ductus was done, the bed of the dissection was inspected for bleeding and leakage of lymphatic fluid. Following hemostasis the edges of the pleura overlying the aorta and ductus were closed with a fine running suture. The lung was reexpanded and hyperinflated and air was evacuated through a forcep during the chest closure without insertion of the chest drain. The intercostal space was closed by sequential figure of eight large dexon sutures. The transected muscles were closed in layers with vicryl 2 and skin layers were closed with fine absorbable sutures (vicryl 2/0). Prior to extubation bilateral air entry were checked and correlated with Oxygen saturation. Fully recovered baby was shifted to ICU into the mother's lap.

In the intensive care unit, heart rate, systemic blood pressure, oximetery saturation (SpO_2) were monitored continuously. Early and 06 hours chest roentgenograms were performed on every patient. Patients were mobilized same day and feeding started within 04 hours and the patients were sent home on the second postoperative day.

Results

Hospital mortality was nil, morbidity included two superficial wound infections. There was no drain related morbidity like haemothorax/ pneumothorax/ Chylothorax. Analgesic requirement were half of those with drains. Feeding was started within 04 hours on the same day. There was no fear of chest drain to child as well as to the mothers and they easily handled their children in their lap. Mobilization was quick and toddlers and older children would be moving about the ICU on the same evening. They were all discharged by second postoperative day.

Discussion

The closure of a patent ductus arteriosus was first attempted Strider in 1937; unfortunately the patient died of postoperative complications. A year later, the first successful closure was performed by Gross and Hubbard[1,2]. Further innovations in the treatment of congenital heart disease are also related to closure of the patent ductus arteriosus; an important innovation includes the understanding of the role prostaglandin in ductal patency and the use of inhibitors of PGEI synthesis to induce closure[3]. Nowadays standard technique for patent ductus arteriosus closures are coil occlusion and video assisted thoracoscopic clipping of patent ductus arteriosus[10]. The role of surgery in managing patent ductus arteriosus was studied in the era of Rash kind double umbrella device and the data suggested that surgery plays a major role in the management of patient with patent ductus arteriosus[8]. The video assisted thoracosopic surgery offered a new modality of treatment of for patent ductus arteriosus in a wide range of body size and age.VATS clipping requires minimal operating time and avoids morbidity[9].

In Pakistan in general and NWFP in particular expertise / equipment for coil occlusion or VATS ligation is not available / scarce. Therefore since 1989 we have been doing transthoracic ligation of patent ductus arteriosus with chest drain insertion. Initially drain used to kept in for minimum 48 hrs. However it was noticed that both the mother and the baby were very scared of chest drain. Mother would be reluctant to hold the baby and the baby would be scared as well. Consequently feeding and mobilization would be delayed while analgesia and at times sedation would be required in higher doses. Gradually we cut down the postoperative drain time to 24 hours and then to taking them out the same evening. We found mother and baby both responded by fast tracking to recovery. This led us to try and do away with the chest drain altogether by selecting a low risk group of patients (< 07 years, no adhesions, no pulmonary pathology, nonrupture) and by checking the lung for full expansion after ligation of patent ductus arteriosus. By hyperinflating the lung during closure we did away with chest drains. This was followed by intensive postoperative monitoring including chest examination, pulse oximetery and chest x-ray within one hour. By adopting this regime we have no mortality and only two wound infections. There was no morbidity due to absence of chest drain i.e. pneumothroax, haemothorax or chylothorax. Theses babies immediately upon arrival to ICU were placed in the mother's lap, which was very reassuring for both mother and baby. After 04 hours they were allowed orally. During this time they were periodically examined SA O_2 recorded and chest x-ray done. Analgesic requirement was greatly reduced and by evening toddlers and older children would move around the ICU. By second postoperative day they were discharged home. At ten days follow up chest x-ray was done which were all normal. There would be no stitches to remove as skin was closed with subcuticular 2/0 vicryl and there were no drain stitches. The babies had patent ductus arteriosus ligated without the trauma of the chest drain and stitch removal with no adverse effects. In addition to the clinical benefits, cost saving is another advantage. The cost

of a chest intubation kit ranges from Rs. 1200 – 3500, depending upon the brand of chest bottle used. This saving of Rs. 1200 – 3500 is a major consideration in our socio economic environment where 60% of the population lives below the poverty line.

Conclusion

Transthoracic ligation of patent ductus arteriosus is and will be the standard treatment for patent ductus arteriosus in our setup for quite a few years, till coil occlusion and VATS clipping become more affordable and widely available. Tube thoracostomy can be avoided in most of the patients with no adverse effects, provided the inclusion criteria (< 7 years, no pulmonary adhesions / pathology, non rupture, good peroperative lung expansion) and postoperative protocols (clinical examination, pulse oximetery, Chest x-ray) are adhered to. This results in major cost saving and greatly reduced trauma and analgesic requirement leading to early feeding, mobilization and discharge.

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