Subtotal median sternotomy for heart surgery

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Received 7 September 1999; received in revised form 13 December 1999; accepted 21 December 1999

Abstract

Objective: Many approaches for minimally invasive heart surgery are available. Although they have many advantages, inadequate exposure, mammary artery injury and special tool requirements are known problems. Subtotal median sternotomy (SMS) was developed to overcome such limitations. Comparing the SMS with the standard sternotomy (SS) is the purpose of this study. Methods: SMS was used in 210 patients (group I) requiring coronary artery bypass grafting and or valvular surgery. This was compared with another 210 patients (group II) in which SS was used. The technical difficulties, incisional discomfort, wound infection, patient satisfaction and hospital stay are the comparison criteria.

Results: (1) SMS takes an average of 24 min longer, P < 0.15. (2) Incisional discomfort graded (I ‘least’ to III ‘greatest’), group I: (27 Grade I, 176 Grade II, seven Grade III). Group II: (21 Grade I, 183 Grade II, six Grade III), P < 0.1. (3) Wound infection: two superficial, two deep in group I, four superficial and one deep in group II, P < 0.06. (4) 99% satisfaction and 5.4 days mean hospital stay in group I, 63% and 7.1 days in group II, P < 0.01 and < 0.03, respectively. Conclusion: When comparing the SMS technique with the SS: (1) SMS has statistically significant better patient satisfaction; (2) can be very cost effective due to the short hospital stay and the absence of a need for special instruments. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Minimum invasive coronary surgery; Sternotomy; Coronary bypass surgery

1. Introduction

Various minimally invasive approaches for heart operations were developed. These include parasternal [1], rightsided partial sternotomy [2] and T lower half sternotomy [3]. Although these methods have many advantages, some difficulties are encountered, e.g. suboptimum exposure, mammary artery injury, and requirement of special instruments or different cannulation maneuvers.

In a trial to minimize these problems, and to provide a less invasive approach, a superior median sternotomy technique was developed and tried in consecutive 210 patients requiring coronary bypass grafting and/or valvular surgery.

The purpose of this study is to compare the outcome of the patients who had subtotal median sternotomy (SMS) and the standard sternotomy (SS).

2. Methods

A consecutive 210 patients (group I) requiring coronary
standard long one that other patients had. The overall satisfaction of the outcome was also recorded.

2.1. Surgical techniques

All the operations were done under standard cardiopulmonary bypass. In the SS a standard long skin incision from the suprasternal notch to the lower end of the xiphoid was used followed by full midline sternotomy. In the SMS the skin incision is made in the midline from the level of the sternum-xiphoid junction to the fifth or sixth intercostal space (Fig. 1). The incision is deepened down to the periosteum, at this plane a right angle Richardson retractor [4] is used to retract the top angle of the incision. With the electrocautery the dissection is carried up to the supra-sternal angle. The lower angle of the incision is then lifted by the retractor and the dissection is continued down to the Xiphoid process. A median longitudinal sternotomy from the supra-sternal angle down to the sterno-xiphoid junction is made.

Standard mammary retractor is used to harvest the internal mammary artery. A ‘Codman Ankeney sternal retractor, model: 50-8069’ with two blades only, is then used to separate the sternal edges. The free mobility of the blades helps in adjusting the retractor to produce equal tensions on both sternal sides. The pericardial sac is opened longitudinally. The ascending aorta is used for arterial cannulation with a standard available cannula. The right atrium is cannulated for venous return in all cases, a smaller two stage cannula (dlp 40/32; Medtronic, San Diego, CA) delivers excellent adequate return. Due to the smaller incision, excellent exposure of the heart is achieved after full cardioplegic arrest and aortic root venting. Also the use of small folded 4 £ 4 sponge on a long artery forceps is very helpful to retract and expose the different sides of the heart inside the chest cavity.

Statistical analysis was performed by using the unpaired t-test and Fisher’s exact test for the comparison between the two groups. $P$-values less than 0.05 were considered significant.

3. Results

3.1. Length of procedure

Minimally invasive SMS technique (group I) takes an average of 24 min longer than the standard method SS (group II), $P = 0.14$. No significant difference in the pump and the clamp time.

3.2. Incisional discomfort

Grade I to Grade III was placed to assess the degree of the post-operative discomfort (Grade I being the least and Grade III being the greatest discomfort). It was found that in group I: 27 patients Grade I, 176 patients Grade II and seven patients Grade III. In group II: 21 patients Grade I, 183 Grade II and six patients Grade III, $P = 0.09$.

3.3. Wound infection

In group I: two patients developed superficial wound infection and two patients had deep infection. In group II: four patients had superficial and two patients had deep infection, $P = 0.06$.

3.4. Patient satisfaction and hospital stay

In group I: 99% satisfaction, mean hospital stay 5.4 days. Group II: 63% satisfaction, mean hospital stay 7.1 days, $P < 0.01$ for patient’s satisfaction and 0.03 for hospital stay (Table 2).

3.5. Mortality

Seven patients died in group I (3.3% mortality rate), and
five patients in group II (2.3% mortality rate). The difference is not statistically significant: \( P = 0.10 \). All the deaths were post-operative and causes were stroke, sepsis and multi-organ failure in patients with low ejection fractions and combined longer procedures.

4. Comment

Conducting cardiac operations through smaller incisions has gained more attention recently because of its potential to reduce the post-operative morbidity and the hospital stay. Minimally invasive cardiac techniques are ranging from using very small Port-Access methods [5] to a standard long sternotomy for coronary bypass grafting on beating heart with no cardiopulmonary bypass [6].

The requirement of thoracoscopy, fluoroscopy, special designed instruments and femoral cannulations for cardiopulmonary bypass in the Port-Access method and the limited accessibility of the coronary arteries in the beating heart surgery, stimulated the search for other techniques that could allow the performance of all possible cardiac procedures through minimum incisions and the use of the standard instruments to avoid the cost increase. Based on this concept the mentioned limited median superior sternotomy was developed and consecutively tried in the described 210 patients. The exposure was adequate in all cases. Although no need to change to the SS technique was required in this group of patients, the SMS approach can be easily and quickly converted to a full sternotomy incision should the need for this arise. No increase in the wound infection was observed compared to the standard approach. In the SMS group, earlier patient ambulation was noticed in spite of the non-statistically significant difference in the degree of the postoperative pain. Despite the fact that the pump and the clamp time were not significantly different, the SMS required slightly longer time to perform. This increase time was due to mainly the opening of the chest and dissecting the internal mammary artery.

Theoretically the limited incision reduces the opening of the upper abdominal portion of the linea alba and also limits the excessive retraction on the sternal edges and the vertebrocostal joints. Hospital stay was shortened significantly in the SMS group.

The patients were very thrilled by the cosmetic look of the short incision (Fig. 2). Although hospital stay was shor-
tended significantly in the SMS group, a bigger sample is needed to solidify this issue.

Due to the simplicity, the safety and the excellence of this method’s outcome, we believe that a subtotal median sternotomy could be a useful approach in cardiac surgery during the era of minimally invasive surgical techniques.

References


Appendix A. Conference discussion

Dr J.R.L. Hamilton (Newcastle-upon-Tyne, UK): Presumably these two sets of patients were operated on over different time frames, if they were consecutive patients?

Dr Ali: We started the technique at the beginning of 1998, and we used it consecutively. This was compared to patients with the standard technique that was done 1 year earlier. As I said, because we’re operating on the same group of patients, at the same center, and with the same referral pattern, the demographic data wasn’t very different between the two.

Dr Hamilton: Obviously, you’ve got some convincing results and yet it would have been easier to convince us had you randomized prospectively. Presumably the information you collected on your standard group was retrospective and therefore the patient satisfaction information must have been difficult to obtain.

Dr Ali: Well, not really. The patients in both groups were followed and called by phone to answer a questionnaire about how they felt about the incision. Actually, it’s very interesting, because some of these patients were very jealous when they compared their standard incision with the shorter ones. We think our data is valid, because we have a control (patients with the standard incision) and the data were collected based on a specific questionnaire.

Dr Hamilton: Are you going to do a prospective randomized trial to challenge us the next time?

Dr Ali: It could be done, however, I think it is not necessary because it will not add much.

Dr A. Sosnowski (Leicester, UK): Did you inform the patient that the operation would be done in a different way?

Dr Ali: No, we do not. In our group some surgeons used this technique (short incision) all the time in all patients. Others do the standard incision in all cases. In other words, it is not a prospective study.

Dr Sosnowski: I just wonder if patients were aware that they had been done slightly differently, because that can influence the patients’ later feelings. A patient knows that a smaller incision must be better; he can see it actually.

Dr Ali: You are right. However, because it is the surgeon’s preference and since it is not the standard incision for all the surgeons in our group, there is no way to tell the patients pre-operatively. I hope this answers your question.

Dr J. Pirk (Prague, Czech Republic): As far as I understood, the only difference is the length of the skin incision, that’s the only difference between these two groups?

Dr Ali: No. The skin incision is one of the differences. The other thing is cutting the sternum down to the junction between the xiphoid and the sternal body.

Dr Pirk: You didn’t show any slide about what is your sternal incision. I didn’t understand, is it median sternotomy or is it partial sternotomy?

Dr Ali: It is superior partial. It is the upper part of the sternum.

Dr Pirk: But you haven’t shown a slide, so nobody knows what you have been doing with the sternum. You have shown only the slide of the skin incision.

Dr Hamilton: Did your sternotomy go right to the top?

Dr Ali: Yes, it started from the top. Can you put the slides back again? (Slide) This is the skin incision.

Dr Pirk: Go back. So this is the skin incision?

Dr Ali: Yes.

Dr Pirk: And where is your sternal incision?

Dr Ali: Starts from there (pointing to the supra-sternal notch).

Dr Pirk: But you haven’t shown it and where it goes down.

Dr Ali: This is what I tried to show you (pointing from the supra-sternal notch to the sterno-xiphion junction).

Dr Hamilton: So what part of the sternum is still intact?

Dr Ali: The lower part of the sternum is still intact.

Dr Pirk: But how do you spread it? Do you make a J or L?

Dr Ali: No, there is no J. When you go down to the junction between the xiphoid and the sternal body, this is a flexible joint. So when you put the retractor it opens it up. You don’t need to cut the sternum sideways. The xiphoid is cartilaginous and separates easily.