

Reusable instruments are more cost-effective than disposable instruments for laparoscopic cholecystectomy

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Abstract. Health care costs are rising rapidly, and surgeons can play a role in limiting costs of operations. Of the 600,000 cholecystectomies performed each year in the United States, approximately 80% are performed with laparoscopic technique. The purpose of this study was to compare the costs of reusable vs disposable instruments used during laparoscopic cholecystectomy.

The costs to the hospital of reusable and disposable instruments were obtained. Instruments studied were the Veress needle, trocars and sleeves (two 10 mm and two 5 mm), reducers, clip appliers, and clips. In addition, the costs of sterilization and sharpening for reusable instruments were calculated. The cost of reusable instruments was based on an assumed instrument life of 100 cases.

Data from three private hospitals and a Canadian university hospital were collected and examined.

Data from the four hospitals revealed that the costs of reusable instruments per case were \$46.92–\$50.67. The comparable costs for disposable instruments were \$385.28–\$515.48. The advantage was thus \$330.00–\$460.00 per case. Theoretical advantages of disposable instruments such as safety, sterility, and better efficiency are not borne out in literature review. In addition, the environmental impact of increased refuse from disposable instruments could not be exactly defined.

With the consideration of significant cost savings and the absence of data demonstrating disadvantages of their use, reusable instruments for laparoscopic cholecystectomy are strongly recommended.

Key words: Laparoscopic cholecystectomy – Instruments – Costs – Reusable – Disposable

Health care costs in the United States are rising at an alarming rate. Governmental concerns will lead to increased regulations. Since surgeons are responsible for costs related to operations, any savings that we can achieve without jeopardizing patient safety should be attempted. Since approximately 80% of the 600,000 cholecystectomies performed each year in the United States are done by the laparoscopic technique [2, 4], we decided to look at the cost of this operation in relation to reusable vs disposable instruments.

Methods

The costs to the hospital of reusable and disposable instruments were obtained from supervising nursing personnel at three private hospitals and a Canadian university teaching hospital. The instruments included in this study were the Veress needle, trocars and sleeves (two 10 mm and two 5 mm), reducer (wafer or metal sleeve), clip applier, and clips. The cost of reusable instruments was based on an instrument life of 100 cases. Other instruments and accessories, such as sleeve retaining devices, suction irrigation devices, tissue graspers, dissectors, and scissors were not included in this study. Two reusable clip appliers and two packages of clips were assumed in our calculations.

Costs of cleaning, sterilization and packaging of reusable instruments were estimated from discussions with operating room and central supply personnel. These costs included 2 min of decontamination, disassembly, and inspection; 1 min of assembly and wrapping; and 1 min of steam sterilization per instrument. Total labor time was estimated at 4 min per instrument per case. A total of 11 instruments was assumed.

It was assumed the trocars were sharpened at approximately 30-case intervals. The cost of sharpening per trocar was calculated.

Conversion from Canadian to United States dollars was based on the assumption that \$1.00 (Canada) equals \$0.85 (USA).

Results

The results are summarized in Table 1. This reveals the total costs from the four hospitals for disposable and reusable instruments. Table 2 shows the breakdown for one hospital which uses disposable trocars primarily. Table 3 shows the breakdown for a hospital which uses reusable trocars primarily.

Table 1. Cost (per case in US dollars)

| Hospital (D/R) | Disposable (D) | Reusable (R) | Ratio |
|----------------|-----------------------|--------------|-------|
| A | \$436.23 ^a | \$50.55 | 8.8 |
| B | \$385.38 ^a | \$50.67 | 7.6 |
| C | \$515.48 | \$48.78* | 10.6 |
| D | \$460.61 | \$47.12* | 9.8 |

^a Preferred at that hospital.

Table 2. Hospital A (US dollars)

| Instrument | Disposable | Reusable |
|------------------------------|------------|----------|
| Sleeves/trocars/reducer | \$274.82 | \$13.72 |
| Veress needle | 21.50 | 1.05 |
| Clip applicator ^a | 139.91 | 14.95 |
| Clips | — | 10.83 |
| Sterilization | — | 8.80 |
| Sharpening | — | 1.20 |
| Total | \$436.23 | \$50.55 |

^a Based on two reusable instruments.

Table 3. Hospital C (US dollars)

| Instrument | Disposable | Reusable |
|------------------------------|------------|----------|
| Sleeves/trocars/reducer | \$338.50 | \$14.30 |
| Veress needle | 22.50 | 0.88 |
| Clip applicator ^a | 154.48 | 13.00 |
| Clips | — | 10.20 |
| Sterilization | — | 9.20 |
| Sharpening | — | 1.20 |
| Total | \$515.48 | \$48.78 |

^a Based on two reusable instruments.

Hospital A is a private Catholic hospital which uses disposable trocars opened separately. Hospital B is a private hospital which uses disposable trocars supplied in a kit along with a disposable clip applicator. Hospital C is a private hospital which uses reusable trocars primarily. Hospital D is a Canadian university hospital which uses reusable trocars primarily. Cost considerations have prevented the use of disposable instruments at hospital D and they are not available there.

Sterilization of reusable instruments had a calculated cost of \$0.80 per instrument per case. This expense is calculated based on protective caps, gowns, masks, shoe covers, gloves, and eyewear for workers. It was not possible to calculate other maintenance costs except sharpening, which was assumed to occur at 30-case intervals. This was actually variable among hospitals, with the hospitals utilizing reusable instruments performing sharpening on a regular scheduled basis. Costs of training for nurses and other personnel were not included.

The cost savings was thus approximately \$330.00–\$460.00 dollars per case. If one assumes that

75% of the current laparoscopic cholecystectomies are performed with disposable instruments, this means that this cost savings could be accomplished in approximately 360,000 cases per year in the United States. In Canada this saving would occur in approximately 36,000 cases.

Discussion

From the perspective of cost containment, the use of reusable instruments in laparoscopic cholecystectomy is clearly advantageous. Although cost is a key element in selecting instruments for use, other factors should be considered, such as patient safety, sterility, surgeon preference, and environmental impact.

The reader should remember that this is a pilot study based on calculations rather than actual patient bills. In addition, these charges represent costs to the hospitals and do not represent patient charges, which will be 20–200% above the charges listed above.

One criticism of reusable instruments relates to the clip applicator. Surgeons who prefer disposable clip applicators state that increased operating-room time with the reusable instrument negates the cost advantage. We decided to estimate this by assuming that a 5-min increase in operative time could be attributed to a reusable clip applicator. In one hospital we found that the operating room charge was \$195.00 per hour, anesthesia charge was \$180.00 per hour, scrub technician wage was \$12.50 per hour, and a circulating nurse wage was \$15.00 per hour. Utilizing these figures, an increase of 5 min per case would cost \$33.55. With this additional expense a substantial cost savings still exists, since it brings the cost of reusable instruments up in the range of \$80.00–\$90.00 compared to \$300.00–\$400.00 for the disposable. If one looks at the clip applicator alone it brings the cost up to \$46.00–\$48.00 per case compared to \$140.00–\$150.00 per case. Reusable clip applicators still retain a considerable cost advantage.

Another criticism of reusable instruments is related to the sharpness of the trocars [3]. A dull trocar could result in increased operative time [3] and a compromise in patient safety [6, 11]. Corson et al. demonstrated that insertion of a reusable trocar required two times the force required for a disposable trocar insertion [3]. However, no increase in injury rate was demonstrated in his study. One solution to this problem might be more frequent sharpening of trocars. Sharpening of trocars at a 15-case interval would add only approximately \$1.20 per case and might insure sufficiently sharp instruments with every use. Alternatively, a disposable trocar could be used with a reusable sleeve. We have not analyzed the cost of this policy but, in general, trocars are much less expensive than sleeves. Another option is open-trocar insertion with a Hasson-type cannula.

Another theoretic argument against the use of reusable instruments is that some reusable instruments cannot be adequately cleaned because of instrument design [6]. In our study, from interview with appropriate per-

sonnel, this was not found to be the case. Instruments in general were easily disassembled and thoroughly cleaned without difficulty. In addition, steam sterilization has been reported to be an effective method of sterilization of laparoscopic instruments [5]. Although residual debris may be present (i.e., "dirt") the instruments *are* sterile after autoclaving. No cases of wound or other infection have been reported due to this theoretical problem.

One technical consideration for trocar use relates to intraoperative cholangiography. If the surgeon performs static cholangiograms, the metal reusable sleeve may obscure the common duct. Most disposable sleeves are radiolucent and thus avoid this problem. One can minimize it with a reusable sleeve by carefully considering port placement or by rotating it to do the cholangiogram.

Other detractors of reusable instruments state that the retractable sleeve of disposable trocars enhances patient safety [6, 7]. This advantage appears to be theoretical with little data in the surgical literature to support a safety advantage once a previous pneumoperitoneum is created. Voyles, in a study of 500 laparoscopic cholecystectomies performed with reusable trocars, found no injuries or other morbidity secondary to their use [9]. Apelgren and Scheeres have reported two cases of aortic injury during initial trocar insertion, each with a different brand of disposable trocar [1]. Thus, injury during trocar insertion seems to be more related to body habitus and to the experience and training of the surgeon than to the type of trocar used.

Another important consideration in the decision as to which type of instrument to use is surgeon preference. Most general surgeons in the United States were trained utilizing disposable instruments. The companies manufacturing such instruments invest considerable effort and financial resources in such training. It is therefore not surprising that many surgeons prefer the instruments that they were trained with. However, without evidence demonstrating disadvantages of properly maintained reusable instruments, surgeon preference should be changed. Surgeons who use reusable instruments will be preferred over those who use disposable instruments by insurance companies and other cost-conscious health-care funding organizations. Such data are already available without patient or surgeon consent to insurance companies. Economic pressure on surgeons to use reusables may intensify, just as the pressure to convert from open to laparoscopic cholecystectomy caused surgeons to learn and practice the latter technique.

The environmental impact of disposable instruments is also an important consideration. Recent articles have described the adverse environmental impact of disposable surgical supplies [8, 10]. Although disposable laparoscopic instruments make up only a small portion of surgical waste, it is a significant one. Some European countries are now requiring that the cost of a disposable instrument include the cost for incineration or other disposal practices.

Conclusion

The use of properly maintained reusable instruments is clearly more cost-effective than the use of disposable instruments for laparoscopic cholecystectomy. Without evidence to demonstrate the theoretical advantages of disposable over reusable instruments, we strongly recommend the use of reusable instruments because of considerable savings in health care costs.

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