

Development of Laparoscopic Surgery in Rural India A Pilot Study

Abstract

There is controversy as to whether Laparoscopic Surgery (LS) should be promoted in rural surgery, on the assumption that the cost-benefit-ratio is questionable. This study was conducted to explore the present situation in rural India and the prospective development as seen by our surgical colleges. In Summer 2009 a telephone survey was carried out among the members of the Association of Rural Surgeons of India (ARSI). Amongst the 450 members we were able to complete 40 questionnaires.

Statistical and descriptive analysis was performed. The lengthy questionnaire partially caused incomplete answers and inconsistent data, so results have to be taken with caution:

80% of the questioned surgeons are practising LS. The median cost of open cholecystectomy is 10000 INR (~140 €) with LS being 40-50% more costly. The main reason given is the invested equipment of 7-10 Lakh (~10 000 to 14 000 €). But there is no correlation to be seen between investment and the higher cost of LS.

Difficulties encountered practising LS are financing equipment, repair, acceptance by patients and lack of training. Complications or conversion-rate caused no greater difficulties. The main benefit is seen in short hospital stay and reduced pain with 70% of surgeons seeing a positive cost-benefit-ratio.

In the next 5 years investment in LS is planned to be doubled, whereas 30% do not intend to make any investment in LS mainly due to high cost or lack of training. Aspects considered difficult to obtain when installing LS equipment are durable equipment at low cost with easy maintenance. In conclusion, there is an unexpected high development of LS among rural surgeons in India however, there is an extensive need for durable equipment at low cost with easy maintenance and training opportunities.

Background

Since the early 1970's pioneers in India have set mile stones in laparoscopy and later in laparoscopic surgery (LS)^[2]. In time many of these hospitals became specialised high volume centres based in major cities. With two thirds of India's population living in rural areas and one third of the population living below the poverty line, access to sophisticated surgery is limited. However these patients benefit most from the early return to work after minimal access surgery^[3,4]. The scope of operations in the rural setting is considerable and often cost-cutting, ranging from diagnostic laparoscopy saving CT or MRI scanning or laparoscopic vagotomy saving a life long medication on proton pump inhibitors with cholecystectomy, appendectomy and sterilisation making up the most of operations^[5,6,7,8,9]. There is concern whether LS is to be promoted in rural hospitals due to concerns of a greater consumption of resources^[10]. Cost effectiveness is a key issue, thus forcing the rural surgeon to improvise^[11,12,13]. One of the main cost factors is the investment in surgical instruments and equipment (camera, light, monitor, CO₂-insufflator, etc.).

Methods

This study is to determine the availability of LS in rural India with present investments and the projected development of LS, the need for facilities and financial resources. Special emphasis is placed on the surgeon's needs. For this pilot study a telephone survey [Appendix I] was carried out among the members of the Association of Rural Surgeons of India (ARSI). The members directory of ARSI^[14] listed approximately 450 members. Of these members 140 telephone numbers could be identified through internet research.

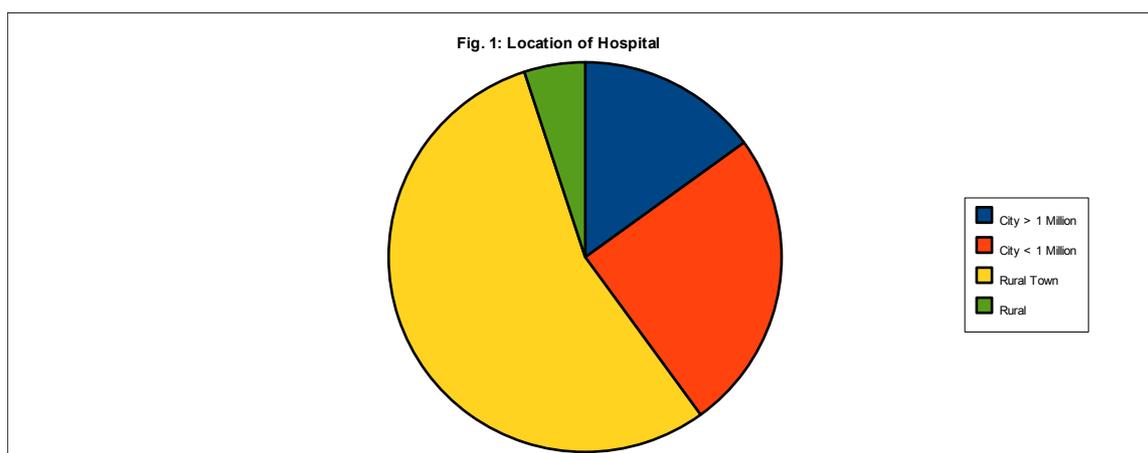
In July and August 2009 six students of paramedical technology based in Bhubaneswar, Orissa, India conducted the telephone survey. Raw data was tabulated there and then sent to Germany, where statistical (Student t-Test) and descriptive analysis was performed.

Results

Of the 140 telephone numbers of ARSI members it was possible to complete 40 questionnaires. The lengthy questionnaire partially caused incomplete answers and inconsistent data, so results have to be taken with caution.

Results Part I: Specification of hospital

85% of surgeons answered that they are practising in hospitals with less than 100 beds and the rest are working in hospitals with more than 400 beds. Per hospital there are 1 to 50 operating doctors (median 2, mean 7,3). 60% of the hospitals are located in rural towns or completely rural and 40% in cities [Fig. 1].



Median distance to the next referral hospital is given with 20km (range 0 to 300km). 75% are privately funded, 15% by the government and 10% by NGO's. 68% of the hospitals treat at least 50% of the patients below the poverty line with a median poverty line of 60% (range 7 to 90%). During the course of the telephone survey it was seen that the question of how many operations had been performed in the different ways was too long resulting in only 9 respondents semi-completing this question. So during the survey the question was changed to how many operations are done in total. Total operations in the last year were given between 180 and 7000 (median 400).

The median cost of open cholecystectomy is 10 000 INR ranging from 3 000 to 20 000 INR. Laparoscopic cholecystectomy is 40-50% more costly (range 5 000 to 30 000 INR, median 12 500 INR) where to answers are more than double as costly and one is cheaper. Wilcoxon Signed Ranks Test gives a $p=0,002$ highly significant difference, demonstrated in box plot [Fig. 2].

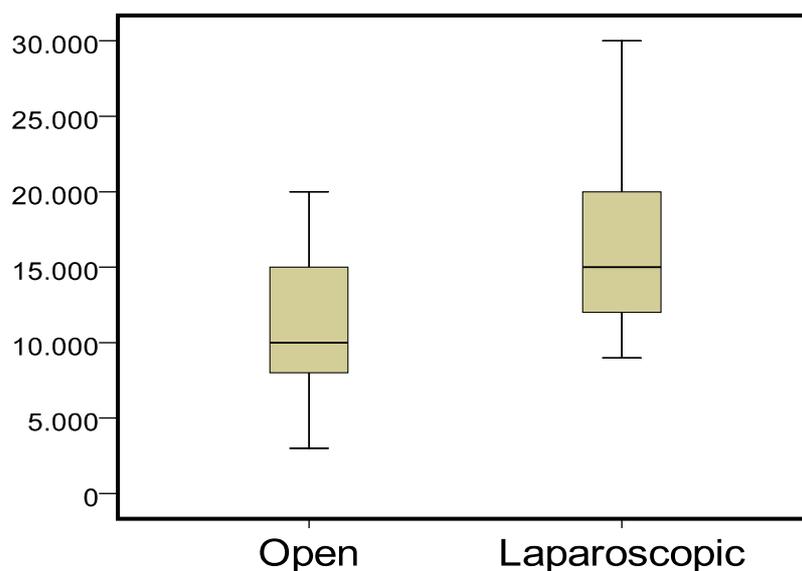
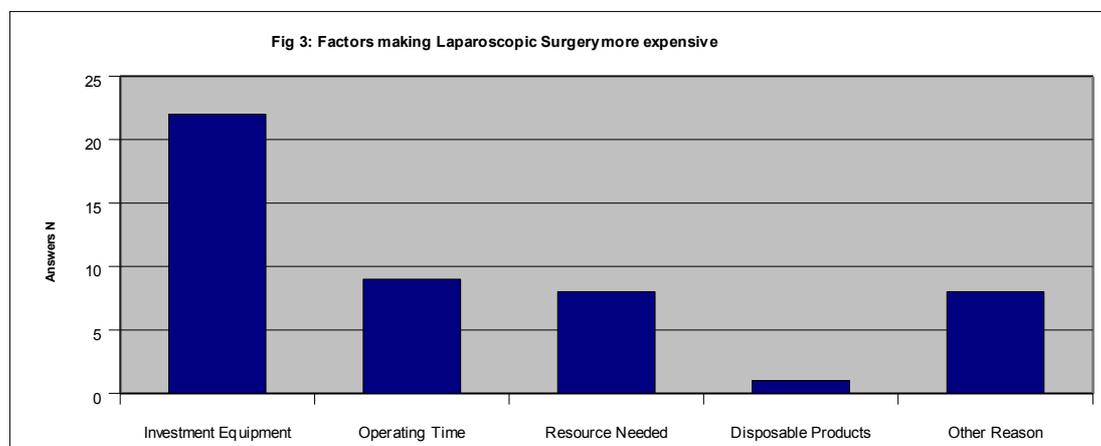


Fig. 2: Box-Plot Open vs Laparoscopic Cholecystectomy

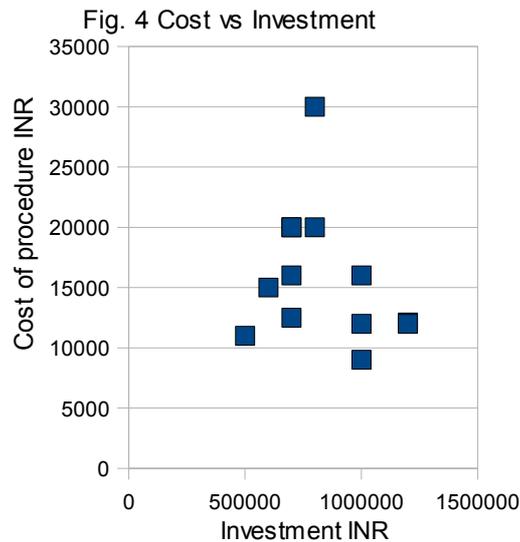
80% of the questioned surgeons are practising LS. Of the 20% not doing any LS the main reason given was lack of training followed by high cost and no benefit.

Results Part II: Laparoscopic surgery at present in the questioned hospital

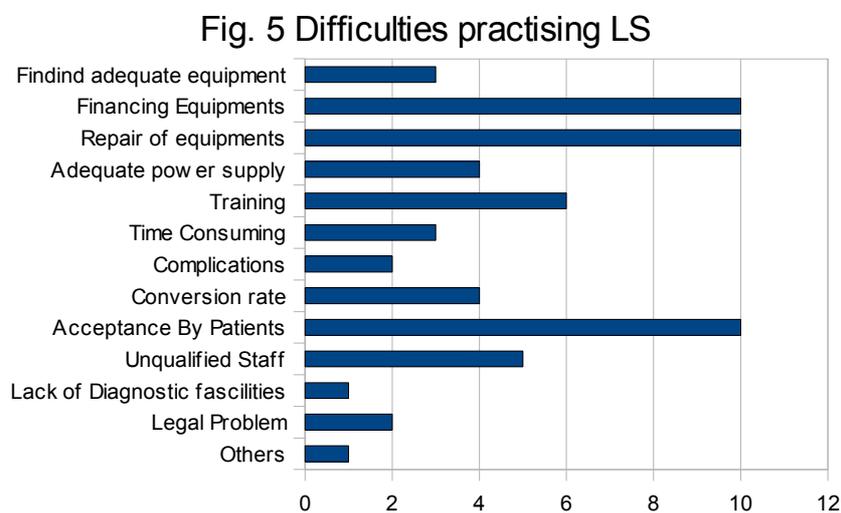
The main factor given for making LS more expensive is the invested equipment (n= 22 answers), followed by operating time (n= 9) and resources needed (n= 8) [Fig.3].



The investment in LS equipment and instruments is given at a mean of 9 62 500 INR (range 5 Lakh to 25 Lakh INR, mean 7,5 Lank INR). There is no correlation to be seen between the stated invested equipment and the higher cost of LS [Fig. 4].

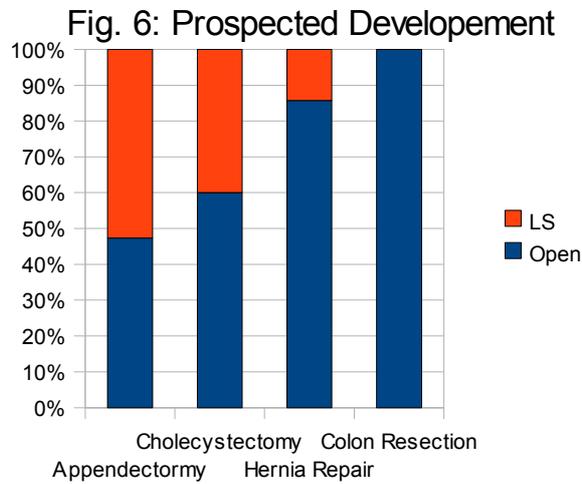


26 surgeons use CO₂ for pneumoperitoneum, 10 use air, no one mentioned abdominal wall lift. 16 use conventional halogen, 15 use cold light source. A total of 16 use disposable products like harmonic scalpels, endostaplers or endobags, where as only 13 are using 'self made' material such as endo-loops, self made sutures or condoms as endo-bags. All questioned surgeons still use ether, with 66% using more sophisticated anaesthetics. Difficulties encountered practising LS are especially financing equipments, repair of equipments and acceptance by patients followed by training. There were no greater difficulties seen due to complications or conversion rate. 20% of hospitals had trained a total of 60 (range 1-50) surgeons in the past year in LS. Difficulties encountered practising LS are financing equipment, repair, acceptance by patients and lack of training. Complications or conversion-rate were no greater difficulties [Fig. 5].



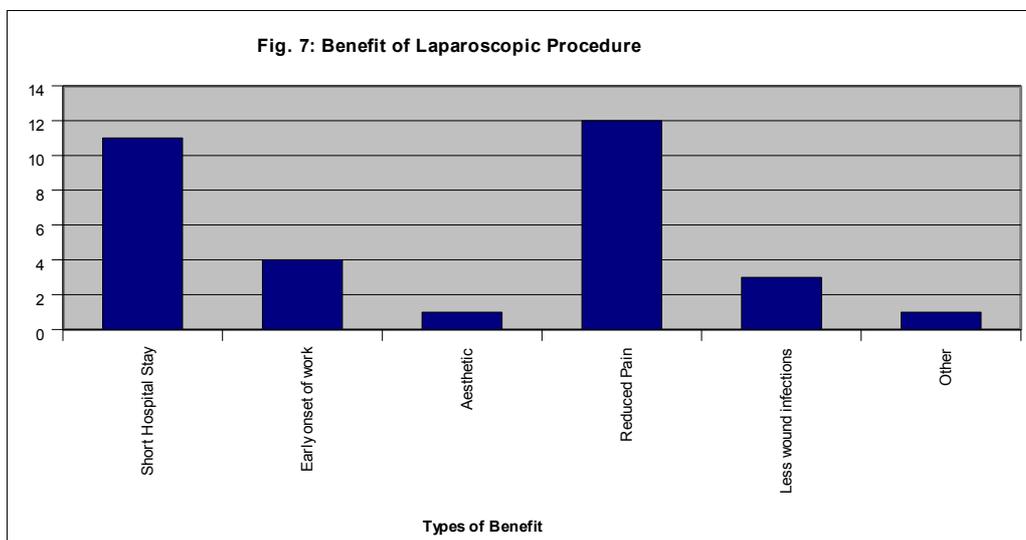
Results Part III: Prospected development in the next 5 years

The judged development of LS and open surgery in the next 5 years is seen that Appendectomy and Cholecystectomy are important laparoscopic procedures. Where as Colon resection and Hernia repair are seen to be the area of open surgery [Fig. 6].



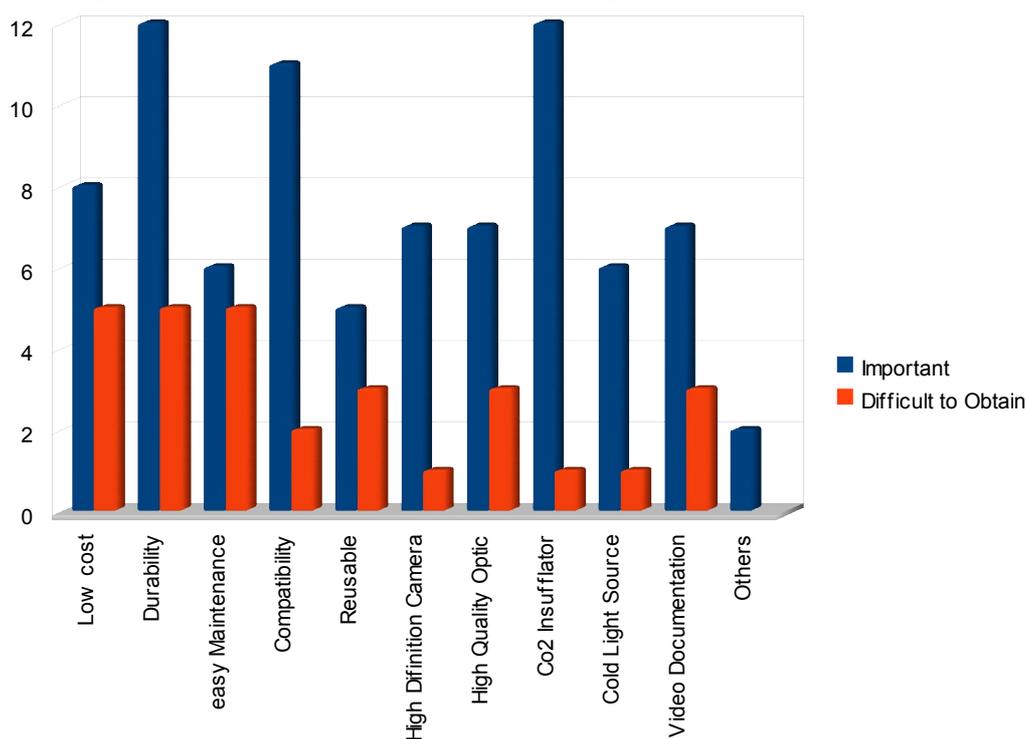
In the next 5 years 8 surgeons stated on planed investment in LS which doubles their investment on average up to date. Where as 30% do not intend to make any investment in LS mainly due to high cost and lack of training.

Over 70% of the interviewed see a positive cost benefit ratio. The main benefit is seen in short hospital stay and reduced pain [Fig. 7].



Aspects considered important when installing laparoscopic equipment and difficult to obtain are durable equipment at lows cost, with easy maintenance [Fig. 8].

Fig 8.: Importance and difficulties installing LS



Conclusion and Discussion

Concluding, there is an unexpected high development of LS among rural surgeons in India. But there is a big need for durable equipment at low cost, with easy maintenance and training!

Future questionnaires via telephone should be short and with simple answers. Email-contact and on-line survey might be able to acquire more precise data.

There are incomplete questionnaires due to the length and inconclusive data to be found. One example is that surgeons state to be using circular endostaplers, but not doing laparoscopic colon resection, the main area used for this kind of instruments. One explanation can be the use in open surgery or that there is misunderstanding via telephone interrogation. An other explanation can be that there are sophisticated laparoscopic surgeons working in major centres doing extra work on the side in rural areas, so serving both 'worlds' in India.

Through the search for telephone numbers via the internet and being dependent on reaching the surgeon by phone, there probably is a strong disturbance of representativity of the reached rural surgeons. Probably surgeons in very remote areas will have bad telephone and internet connection and so being under-represented in this survey, explaining the high (80%) usage of LS. So for these colleges a personal or postal questionnaire could be a good opportunity.

The small sample (n=40) gives a bias too. Future studies with approximately 12800 ASI^[15] and 1800 IAGES^[16] members add up to a total of over 14000 potential recipients of a questionnaire, which would give a better base for statistical analysis.

Further these results need to be submitted to industry demonstrating the needs of rural surgeons in India and probably all around the world: sturdy equipment at low cost with a reliable maintenance.

Appendix

Questionnaire: Development of Laparoscopic Surgery in India

☎ = Interviewer

☺ = Doctor

Starting the interview

When reaching the desired Doctor please confirm identity of Doctor for example:

☎ "Hello. Am I speaking with Doctor? " or "Hello. Can I please speak to Doctor?"

☺ Yes.

☎ "My name is Mrs."

I am calling on behalf of the International Leadership and Business Society, Germany. We are conducting a survey to determine what rural surgeon's needs. Please give me just 10 minutes of your valuable time for some questions."

☺ Yes. If answer is NO → give reason: _____ 0a

☎ "Thank you Sir. Are the contact details I have here correct?"

- Your Name is (Surgeon's Name) _____ 1a
- The Hospital Name / Institution _____ 1b
- Your Address _____ 1c
- _____ 1d
- Telephone number _____ 1e
- Email to forward the results of the survey _____ 1f
- _____ 1g
- Your year of birth 19_____ 1g

☎ "Are you MBBS or MS?"

^{2a} MBBS ^{2b} MS

☎ "Do you have a specialisation?"

Specialisation _____ 2c

☎ "I believe you are a member of ARSI?"

^{3a} ARSI (Association of Rural Surgeons of India)

☎ "Are you a member of ASI?"

^{3b} ASI (Association of Surgeons of India)

☎ "Are you a member of IAGES?"

^{3c} IAGES (Ind. Ass. of Gastrointestinal Endosurgeons)

^{3d} Other _____

Part I: Specifications of hospital

☎ "What is the total number of beds in your hospital (incl. medicine and other specialities)"

☺ Number of beds _____^{4a}

☎ "How many operating doctors (surgeons, gynaecologists, orthopaedists, etc.) are posted in your institution?"

☺ Number of operating doctors _____^{4b}

☎ “In what environment in the hospital located?
 In a ^{5a} city with more than 1 million population
^{5b} city less than 1 million population
^{5c} rural town
^{5d} completely rural?”

☎ “How far away is the next referral hospital?”
 ☺ In _____ km^{6a}.

☎ “What is the main funding?”
 ☺ ^{7a} Government
^{7b} Private
^{7c} NGO/Missionary etc

☎ “What percentage of patients are below the poverty line?”
 ☺ Patients below poverty _____ %^{8a} of total patients.

☎ “How many operations were performed in the last year? Please give approximate number for the following procedures and state if open or laparoscopic surgery:”

☺ Approximate number of surgical procedures for the last year:

	<i>open surgery</i>	<i>laparoscopic surgery</i>
<i>Diagnostic laparotomy/laparoscopy</i>	_____ ^{9a}	_____ ^{9b}
<i>Appendectomy</i>	_____ ^{10a}	_____ ^{10b}
<i>Cholecystectomy</i>	_____ ^{11a}	_____ ^{11b}
<i>Hernia repair</i>	_____ ^{12a}	_____ ^{12b}
<i>Colon resection</i>	_____ ^{13a}	_____ ^{13a}
<i>Vagotomy</i>	_____ ^{14a}	_____ ^{14b}
<i>Sterilisation</i>	_____ ^{15a}	_____ ^{15b}
<i>Hysterectomy</i>	_____ ^{16a}	_____ ^{16b}
<i>Ovarial cyst</i>	_____ ^{17a}	_____ ^{17b}
<i>Ectopic rupture</i>	_____ ^{18a}	_____ ^{18b}

☎ “What is the all over cost for a cholecystectomy including charges for surgeon, anaesthetist, medication and hospital stay? Please give cost both for open procedure and as laparoscopic procedure.”

☺ Approximate cost for cholecystectomy as open procedure _____ INR^{19a}
 ☺ and as laparoscopic cholecystectomy _____ INR^{19b}.

*!***! If the hospital has not done any laparoscopic surgery up to date → ask this question:

☎ “What are the main reasons that your hospital has not done any laparoscopic surgery to date? ☺

- ^{20a} high cost
- ^{20b} lack of training
- ^{20c} no benefit
- ^{20d} complication rate
- ^{20e} or other reasons: _____ (please specify)

→ !*!***! in this case (no laparoscopic surgery) please continue with part III

Part II: Laparoscopic surgery at present in your hospital

 “What is the main factor making the laparoscopic procedure more expensive?”



- 21a *invested equipment*
- 21b *operating time*
- 21c *more resources needed*
- 21d *disposable products*
- 21e *or other reasons:* _____ (please specify)

 “How much has been investment in laparoscopic surgery equipment and instruments in your hospital to date?”

 Approximate investment in laparoscopic surgery equipment and instruments in total to date _____ INR^{22a}.

 “What is used to create pneumo-peritoneum?”



- 23a *CO₂*
- 23b *air*
- 23c *abdominal wall lift*
- 23d *or other:* _____ (please specify)

 “What is used as a light source?”



- 24a *conventional halogen*
- 24b *cold light source*
- 24c *or other:* _____ (please specify)

 “Do you regularly use disposable products like:



- 25a *harmonic scalpel*
- 25b *linear endostaplers*
- 25c *circular endostaplers*
- 25d *endo-bags*
- 25e *or other:* _____ (please specify)

 “What kind of 'self made' instruments and materials do you use?”

- 26a *endo-loops*
- 26b *self made sutures*
- 26c *condoms as endo-bags*
- 26d *or others:(please specify!!!)*

 “What kind of anaesthesia is used for laparoscopic surgery?”



- | | <i>all</i> | <i>mainly</i> | <i>some</i> | <i>never</i> |
|---|------------------------------|------------------------------|------------------------------|------------------------------|
| <i>general anaesthesia with ether</i> | <input type="checkbox"/> 27a | <input type="checkbox"/> 27b | <input type="checkbox"/> 27c | <input type="checkbox"/> 27d |
| <i>general anaesthesia with other</i> _____ | <input type="checkbox"/> 28a | <input type="checkbox"/> 28b | <input type="checkbox"/> 28c | <input type="checkbox"/> 28d |
| <i>spinal anaesthesia</i> | <input type="checkbox"/> 29a | <input type="checkbox"/> 29b | <input type="checkbox"/> 29c | <input type="checkbox"/> 29d |
| <i>local anaesthesia</i> | <input type="checkbox"/> 30a | <input type="checkbox"/> 30b | <input type="checkbox"/> 30c | <input type="checkbox"/> 30d |

☎ “What kind of difficulties do you encounter practising laparoscopic surgery? Please state if none, some, often or major difficulties”

☺	none	some	often	major difficulties
finding adequate equipment	<input type="checkbox"/> ^{31a}	<input type="checkbox"/> ^{31b}	<input type="checkbox"/> ^{31c}	<input type="checkbox"/> ^{31d}
financing equipment	<input type="checkbox"/> ^{32a}	<input type="checkbox"/> ^{32b}	<input type="checkbox"/> ^{32c}	<input type="checkbox"/> ^{32d}
repair of equipment	<input type="checkbox"/> ^{33a}	<input type="checkbox"/> ^{33b}	<input type="checkbox"/> ^{33c}	<input type="checkbox"/> ^{33d}
adequate power supply	<input type="checkbox"/> ^{34a}	<input type="checkbox"/> ^{34b}	<input type="checkbox"/> ^{34c}	<input type="checkbox"/> ^{34d}
training	<input type="checkbox"/> ^{35a}	<input type="checkbox"/> ^{35b}	<input type="checkbox"/> ^{35c}	<input type="checkbox"/> ^{35d}
time consuming	<input type="checkbox"/> ^{36a}	<input type="checkbox"/> ^{36b}	<input type="checkbox"/> ^{36c}	<input type="checkbox"/> ^{36d}
complications	<input type="checkbox"/> ^{37a}	<input type="checkbox"/> ^{37b}	<input type="checkbox"/> ^{37c}	<input type="checkbox"/> ^{37d}
conversion rate	<input type="checkbox"/> ^{38a}	<input type="checkbox"/> ^{38b}	<input type="checkbox"/> ^{38c}	<input type="checkbox"/> ^{38d}
acceptance by patients	<input type="checkbox"/> ^{39a}	<input type="checkbox"/> ^{39b}	<input type="checkbox"/> ^{39c}	<input type="checkbox"/> ^{39d}
unqualified paramedical staff	<input type="checkbox"/> ^{40a}	<input type="checkbox"/> ^{40b}	<input type="checkbox"/> ^{40c}	<input type="checkbox"/> ^{40d}
lack of diagnostic facilities	<input type="checkbox"/> ^{41a}	<input type="checkbox"/> ^{41b}	<input type="checkbox"/> ^{41c}	<input type="checkbox"/> ^{41d}
legal problems	<input type="checkbox"/> ^{42a}	<input type="checkbox"/> ^{42b}	<input type="checkbox"/> ^{42c}	<input type="checkbox"/> ^{42d}
other; (please specify) ^{43a}	_____			

☎ “Has your hospital trained any surgeons in laparoscopic surgery in the last year?”

- ☺ ^{44a} no.
^{44b} yes. → ☎ “How many?” ☺ Number surgeons trained _____^{44c}.

III Prospected development in the next 5 years in your Hospital

☎ “Please judge the development of laparoscopic procedures in your hospital in the next 5 years: Will appendectomies be open surgery (all or mainly) or laparoscopic surgery (all or mainly)? How is this with cholecystectomies? With hernia repairs? With colon resections?”

☺	open surgery		laparoscopic surgery	
	all	mainly	mainly	all
Appendectomy	<input type="checkbox"/> ^{45a}	<input type="checkbox"/> ^{45b}	<input type="checkbox"/> ^{45c}	<input type="checkbox"/> ^{45d}
Cholecystectomy	<input type="checkbox"/> ^{46a}	<input type="checkbox"/> ^{46b}	<input type="checkbox"/> ^{46c}	<input type="checkbox"/> ^{46d}
Hernia repair	<input type="checkbox"/> ^{47a}	<input type="checkbox"/> ^{47b}	<input type="checkbox"/> ^{47c}	<input type="checkbox"/> ^{47d}
Colon resection	<input type="checkbox"/> ^{48a}	<input type="checkbox"/> ^{48b}	<input type="checkbox"/> ^{48c}	<input type="checkbox"/> ^{48d}

☎ “What is the planned investment in laparoscopic equipment and instruments in the next 5 years?”

☺ Planned investment _____ INR^{49a}

***! If planned investment is none, ask this question:

☎ “Why is there no intention to expand laparoscopic surgery? What are the main reasons?”

- ☺
- ^{50a} high cost
 - ^{50b} lack of training
 - ^{50c} no benefit
 - ^{50d} complication rate
 - ^{50e} other reasons, (please specify) _____

☎ *“Do you see a positive cost-benefit ratio for laparoscopic surgery for “under privileged” patients (rural, below poverty line, low caste, etc.)?”*

😊

- ^{51a} none
- ^{51b} to some extent
- ^{51c} definitively

*!***! If “to some extent” or “definitely”, ask this question:

☎ *“What is the main benefit?”*

😊

- ^{52a} short hospital stay
- ^{52b} early onset of work
- ^{52c} aesthetic
- ^{52d} reduced pain
- ^{52e} less wound infections
- ^{52f} other, (please specify) _____

☎ *“What aspects do you consider important when installing laparoscopic equipment? What is difficult to obtain?”*

😊

	important	difficult to obtain
low cost	<input type="checkbox"/> ^{53a}	<input type="checkbox"/> ^{53b}
durability	<input type="checkbox"/> ^{54a}	<input type="checkbox"/> ^{54b}
easy maintenance	<input type="checkbox"/> ^{55a}	<input type="checkbox"/> ^{55b}
compatibility	<input type="checkbox"/> ^{56a}	<input type="checkbox"/> ^{56b}
reusable	<input type="checkbox"/> ^{57a}	<input type="checkbox"/> ^{57b}
high definition camera and monitor	<input type="checkbox"/> ^{58a}	<input type="checkbox"/> ^{58b}
high quality optics	<input type="checkbox"/> ^{59a}	<input type="checkbox"/> ^{59b}
CO ₂ -insufflator rather than air	<input type="checkbox"/> ^{60a}	<input type="checkbox"/> ^{60b}
cold light source rather than halogen	<input type="checkbox"/> ^{61a}	<input type="checkbox"/> ^{61b}
video documentation system	<input type="checkbox"/> ^{62a}	<input type="checkbox"/> ^{62b}
other _____	<input type="checkbox"/> ^{63a}	<input type="checkbox"/> ^{63b} SPECIFY!

☎ *“What have you always wanted to tell designers and industry about their products, what do they need to change, what is great?”*

😊^{64a}

☎ *“Have we missed anything important in this questionnaire?”*

😊^{65a}

☎ *“Sir, thank you very much for your patience and your detailed answers!”*

Date^{66a} _____ Interviewer Name^{66b} _____

Comments from interviewer:

^{66c}

References

- 1 The International Leadership and Business Society e.V., Johannesstrasse 14, 78609 Tuningen, Germany, at www.ilbs.org
- 2 Dr. med. Elias Engelking, Hugstetter Str. 19, 79106 Freiburg, eliasengelking@yahoo.com. Surgeon in training at Diakoniekranenhaus Freiburg (Teaching Hospital of the University of Freiburg).
- 3 Udwardia TE: Diagnostic laparoscopy. *Surg Endosc* 2004, 18 (6-10).
- 4 Cadière GB: Laparoscopic surgery and the third world. *Surg Endosc* 1996, 10 (957-958).
- 5 Udwardia TH: Laparoscopy in India - A personal perspective. *J Min Access Surg* 2005, 1 (51-52).
- 6 De U : Laparoscopic versus open appendicectomy: An Indian perspective. *J Min Access Surg* 2005, 1 (15-20).
- 7 Gnanaraj J: Laparoscopic surgery in rural areas. *ANZ Journal of Surgery* 2007, 77 (799-800).
- 8 Manning RG, Aziz AQ: Should Laparoscopic Cholecystectomy be Practised in the Developing World? The Experience of First Training Program in Afganistan. *Ann Surg* 2009, 5 (794-798).
- 9 Mir IS et al.: Laparoscopic cholecystectomy in a small rural hospital in Kashmir Valley, India. *Trop Doctor* 2008, 38 (213-216).
- 10 Ramakrishna HK: Experiences at a M.A.S. unit in a rural area. *Rural Surgery* 2004, 4 (4-7).
- 11 Anita NH: ARSI, Its origin, Present status and Future. *Rural Surgery* 2006, 1 (2-3).
- 12 Jesudian G: Laparoscopic surgery in rural areas. *ANZ Journal of Surgery* 2007, 77(9) (799-800).
- 13 Banerjee JK: Caring for Developing Communities. *Eur J Surg* 1999, 165 (69-71).
- 14 Arun SK, Cost-efficient laparoscopy in India, 125th Congress of the German Association of Surgeons, Berlin 2008,
- 15 ASI Members Directory, July 2009 at www.asiindia.org
- 16 IAGES Members Directory, July 2009 at www.iages.org.in
- 17 ARSI Members Directory, July 2009 at www.arsi-india.org
- 18 Statistical Survey, 26.7.2009 at www.en.wikipedia.org/wiki/Statistical_survey

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