Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.4, No.17, 2013

Effect of Curriculum II, and Bifacial Accreditation on the Outcome of Trainees in a Course of Laparoscopy in Al Sulaimaneyah City /Iraq

Hiwa O. Ahmed (Corresponding author)
School of Medicine / Al Sulaimaneyah University, PO box 13, Al Sulaimaneyah, AN 36, Kurdistan ,Iraq
E-mail: hatwan@gmail.com

Abstract
Background; The use of laparoscopic surgical procedures without previous training has grown rapidly over the last decade. At the same time, there have been allegations of increased complications among less experienced surgeons. As with other surgical procedures, a period of learning is required, especially when new techniques are involved.
Aims; to evaluate accreditation of laparoscopic training for inexperienced surgical trainees
Trainees, materials and methods; As information based, step by step method of training with supervision and feedback in every step we commence the practical part of the course. Instruments were familiarized in a session, and the procedure was fully demonstrated by an experienced surgeon step by step, then dry laboratory on animated boxes, with an opportunity for the trainees to ask questions was arranged .
In the wet laboratory, the trainees were observed by experienced laparoscopist ,who was not always scrubbed in, checking and recording the steps of the procedure
Results; Most of the trainees were male with female to male ratio of 1/5, age ranging from (28 to 37) years, with median age of 31 years .Most of them were 3rd year trainees of Iraqi board of medical specialty –surgery and were inexperienced in laparoscopy
After completion of the course we distributed a questionnaire to the trainees, to validate the items of the course, personal satisfaction, fatigue and perceived changes in knowledge and skills, and practice
Conclusion; the knowledge based learning, a stepwise technical skills in curriculum II, with on spot feedback will teach practical skills for inexperienced surgical trainees ,but they need more training by clinical attachment and assisting in laparoscopy on real patients in the form of curriculum III to be qualified as laparoscopic surgeons. So it is better that training of laparoscopy to be incorporated as early as third year in to the curriculum of training programs for trainees of board of surgery, to give time for further training before qualification as surgeons.
Key words; training, laparoscopy, curriculum, dry lab, wet lab

1. INTRODUCTION:

Laparoscopic cholecystectomy [1] has gripped the interest and fired the imagination of the surgical community over the last three decades [2] and was considered to be ' the most remarkable surgical innovations of the 20th century'. The 21st century finds it to be a mature and safe surgical procedure and the gold standard for the treatment for symptomatic gallstones [3,4,5]
The use of laparoscopic surgical procedures without previous training has grown rapidly over the last decade, at the same time; there have been allegations of increased complications among less experienced surgeons. [6,7] As with other surgical procedures, a period of learning is required, [8] especially for those who the technique is new . [9] Several studies have shown better clinical outcomes after surgeons have gained experience in performing laparoscopic procedures [10]
Practicing surgeons need an effective means for learning new skills and procedures, currently, available educational methods including traditional continuous medical education symposia (1-day courses), instructional videos, mentoring, or comprehensive courses that combine lectures, skills laboratories and live surgery, but its impact on trainees' knowledge, skills and practice has not been clearly established. [11] While it is clear that 'it has a positive impact on attendees' knowledge and skills. it has been recognized that appropriate training is the key to patient safety, specially in developing world [3] where more sophisticated tools of learning like training within a proficiency-based virtual reality (VR) curriculum or simulators are not available ,which may help in reducing errors during real surgical procedures. [12]
So appropriate training in laparoscopic surgery is necessary to train inexperienced individuals to a level of competence in their chosen field in order to avoid operative complications [12, 13]
As a the question of training has not yet been fully addressed, [5] there is a need to provide guidelines for minimum standards relating to training, practice and equipment used for laparoscopic surgery' [14] and fully

trained consultants for training of younger surgeons. [5] versus short courses which is inadequate [11] aiming in provision of a 'safe, effective and ethical way for trainees to acquire surgical skills'[12]
In this era when patient advocate groups may demand evidence of extra training in the surgery specially laparoscopy [14] , it is necessary to explore, define and implement modes of surgical skills training that do not expose the patient to preventable errors [1,5, 12]
The current means for evaluating surgical performance and skill acquisition during training are limited to measurement of task completion time and number of errors [15,16] with the eventual aim of demonstrating a significant reduction in length and gradient of the learning curve during LC on real patients. [12]
How much curriculum II will help the trainees to gain skills and laparoscopic practical tips? Were the slandered checklists helpful in accreditation of the practice of the trainees or we need evaluation of more aspects of the practice in the training courses?

2. TRAINEES, MATERIALS & METHODS:

During the period of one week from 12/03/2011 o 17/03/2011, twelve surgical trainees from Iraqi Board of Medical Specialties-Surgery participated in a course of laparoscopy in the Hatwan's private hospital in Al Sulaimaneyah City. Laparoscopic cholecystectomy (LC) was performed by using American technique by standard four steps in all the cases, [1, 2, and 3]) including: establishing pneumoperitoneum, gallbladder dissection, pedicle detachment, gallbladder detachment and extraction). [17] Insufflation of carbon dioxide was limited to a pressure of 8–15 mmHg. [18] Local anesthetic (plain 0.2% Lidocaine) solutions were given into peritoneal cavity immediately after the creation of a pneumoperitoneum and at the end of the operation. [19] Meticulous dissection close to the junction of the cystic duct and gall bladder was done, [2] the course was curriculum II, as shown in (table 1) [12, 20] which is composed of theoretical lectures ,videos, dry laboratory on animated laparoscopic boxes and wet laboratory on sheep , as a laboratory in vivo training model [5,8] and the national guidelines for the care and use of laboratory animals was followed.
Table I; compositions of the different curricula for training in laparoscopy. With tabulation and some modification from C M S Royston e al. [5]

	Items of the curricula	Curriculum I	Curriculum II	Curriculum III
1	Theoretical lectures	√	√	
	Videos	√	√	
	Instruments familiarization	√	√	√
	Procedure demonstration	√	√	√
	Dry laboratory on animated laparoscopic boxes	√	√	
	Wet laboratory on sheep ,in vivo training model		√	√
	Hands-on courses (Assisting in live surgery)			√
	Proctorships (Clinical attachment)			√

All the surgical trainees were supervised by an experienced surgeon in laparoscopy, with feedback in every step. We commenced the practical part of the course, instruments were familiarized in a session, and the procedure was fully demonstrated, then dry laboratory on animated boxes followed, opportunities for the trainees to ask questions were arranged.
In the wet laboratory, the trainees were observed by experienced laparoscopist ,who was not always scrubbed in, he was checking and recording the steps of the procedure including insertion of Verres needle,CO_2 insufflation, primary port insertion for the camera, 30° camera manipulation, other ports insertion ,eye hand coordination, distant travelling of the hand instruments, anatomy identification and steps of cholecystectomy as grasping the gallbladder, retraction, dissection of the Calot's triangle, identification and dissection of cystic duct and artery, clipping, cutting, dissection of the gallbladder from its bed, haemostasis ,inspection of the bed , freeing of gallbladder, extraction of gallbladder, checking of the field, removal of the ports under direct vision, deflation of the peritoneum, removal of the primary port with the camera .
All the demographic data of the trainees and results of the checklists were collected, and analyzed with SPSS (Statistical package for social sciences) version 16, a value of P less than 0.05 considered statistically significant

3. RESULTS:

Most of the trainees were male with female to male ratio of 1/5, age ranging from (28 to 37)years , with median age of 31 years .Most of them were 3rd year trainees of Iraqi board of medical specialty –surgery and were inexperienced in laparoscopy (done fewer than ten L.C.s)
In pre training questionnaire, the purpose of five trainees (41.6%) in participation in the training was to be familiar with laparoscopy, four (33.3%) to improve their skills of laparoscopy, , and three trainees (25.1%) to learn laparoscopy. All the male trainees were willing to be a surgeon without supervision, while the female

trainees wished to be a surgeon in the course with supervision of experienced surgeon in laparoscopy (table 2). In the response to a question about each trainee's weak points in laparoscopy , only two trainees declared these points as difficulty in dissection of the cystic duct (trainee number one) and Hand-eye coordination, extraction of the GB (trainee number 11). Although the first trainee had experience with more than 10 open cholecystectomies and three LC s , but another trainee had experience with more than four open cholecystectomy and no experience with laparoscopic cholecystectomy.

Table II ; results of pre-raining questionnaire including age, gender, purpose of the joining the course and their selection of steps of the course and type of the of the training

	Gender	Age(year)	Period of training (month)	Purpose of joining	Cholecystectomy		Type of training			Preferred Lab.		Practical Weak point
					OC	LC	assistant	supervised	surgeon	dry	wet	
1	♀	33	54	To be familiar	10	3		√		√	√	Cystic a artery dissection
2	♀	28	18	To be familiar	25	2		√		√	√	Nil
3	♂	31	40	To be familiar	2	0			√	√		Nil
4	♂	33	40	To be familiar	2	0			√	√		Nil
5	♂	30	11	To improve	0	0			√	√		Nil
6	♂	29	36	To improve	2	0			√	√		Nil
7	♂	29	36	To learn	3	0			√	√		Nil
8	♂	35	48	Improve	2	0			√	_		Nil
9	♂	37	48	Improve	6	0			√	√		Nil
10	♂	31	6	To be familiar	0	0			√	√		Nil
11	♂	34	40	To learn	4	0			√	√		-Hand-eye coordination -Extraction of the GB
12	♂	33	36	To learn	10	3			√	√		Nil

Most of them (11 trainees = 91.6%), selected dry laboratory on animated boxes for training, while both female trainees choose both dry and wet (living on animal) training

All of the trainees completed the curriculum successfully with accreditation scores of 60 o 79 for wet laboratory as shown in table 3.

Table III; scoring, errors and negative scoring of he trainees in the wet laboratory according to Eubanks et al. scoring system for LC [21]

Scores	Trainees	Errors	Negative scoring	
60	1	Gallbladder injury	-10	-40
		Liver injury with bleeding	-5	
		Unintentional cystic duct transaction	-10	
		Cystic artery tear	-15	
63	2	Injury o stomach	-25	-37
		Unintentional cystic duct transaction	-10	
		Misplaced clip on cystic duct	-2	
65	1	Gallbladder injury	-10	-35
		Unintentional cystic duct transaction	-10	
		Cystic artery tear	-15	
68	2	Cystic artery tear	-15	-32
		Gallbladder injury	-10	
		Misplaced clip on cystic duct	-2	
		Liver injury with bleeding	-5	
70	3	Prolonged operative time 120 minutes -10 points /15 minutes after firs 90 minutes-	-20	-30
		Gallbladder injury	-10	
79	3	Unintentional cystic duct transaction	-10	-21
		Gallbladder injury	-10	
		Additional attempt a clip placemen on he cystic duct	-1	

After completion of the course a questionnaire was distributed to the trainees, to evaluate the items of the course and personal satisfaction, fatigue and perceived changes in knowledge, skills and practice, (Table 4).

Two third of their validation was very good for theoretical lectures and half validate dry laboratory as excellent, the remaining half as very good , while two trainees validated the wet laboratory as excellent , seven as very good and remaining three as good.

Table IV; showing the results of the trainee's validation of the course.

Trainee	These sections were validated by the trainees as: good - very good - excellent			Validated by the trainees from 1 to 10 scores			
	Theoretical lectures	**Dry lab.**	**Wet lab.**	**Theoretical lectures**	**Dry lab.**	**Wet lab.**	**fatigue**
1	Good	Excellent	Very good	6	9	8	5
2	Good	Excellent	Good	7	10	7	5
3	Very good	Excellent	Very good	8	9	8	5
4	Good	Very good	Excellent	6	8	9	5
5	Good	Excellent	Excellent	6	9	8	7
6	Very good	Very good	Very good	9	8	8	6
7	Very good	Excellent	Very good	8	9	8	5
8	Very good	Excellent	Excellent	8	9.5	8	4
9	Very good	Very good	Good	8	9	7	7
10	Very good	Very good	Good	7	7	8	6
11	Very good	Very good	Very good	7	9	7	6
12	Very good	Very good	Very good	8	8	8	6

Table V; analytical results of he influence of age, duration of surgical residency, open and laparoscopic cholecystectomies done before he course on he accreditation scores of he trainees

trainees	1	2	3	4	5	6	7	8	9	10	11	12
Age (year)	33	28	31	33	30	29	29	35	37	31	34	33
Duration of surgical residency (month)	54	18	40	40	11	36	36	48	48	6	40	36
OC	10	25	2	2	0	2	4	2	6	0	4	10
LC	3	2	0	0	0	0	0	0	0	0	0	3
Accreditation scores in the course	70	70	68	79	68	65	79	63	63	60	70	79
Standard Error	3.010398644698074											
Z-Statistic	<0.0001											
Mann-Whitney's statistic	144.0											
Kruskal-Wallis' statistic	17.42											
The P-Value	<0.0001											

4. DISCUSSION:

The lack of translation of open surgical skills into laparoscopic skills highlighted the needs for a curriculum and the training courses to acquire laparoscopic skills [22]. A training method implemented in our work includes theoretical lectures ,videos ,dry laboratory on animated boxes which is a type of surgical simulator that uses real surgical instruments and equipments including video, monitors, camera and laparoscopes .[23] Wet laboratory[5,13, 14, 20,24] which is the most realistic non-patient environment for laparoscopic training (curriculum II), will help in

teaching inexperienced trainees and improves the skill and practice of trainees with some laparoscopy experience [2,10,11,12,14] now it is clear that short courses 1-2 days are inadequate to teach the required skills.[11]

The implemented program must be detailed enough and step by step, which could teach the anatomical structure recognition skills that can only be gained through experience of watching actual surgeries, Which could possibly reduce the chance of surgical mistakes during laparoscopic cholecystectomy, thereby increasing patient safety. [1] And more likely that they will complete advanced procedures after the course. [11] American trainees perform more than one hundred laparoscopies during their resident ships, 68% of these are cholecystectomies, later in their carrier as surgeons, and they will do laparoscopy very effectively and safely. [17]

Although training is usually supervised, and in accordance with informed consent of the patient, this is probably no longer an ethically or economically viable option for modern medical practice [12] . They must be trained for necessary curricula. One must not wait till the beginner laparoscopist completes his learning curve (of at least 50 procedures), as the actual experience is very heterogeneous [2,17,25] and needs training according to well organized curriculum [11] . While surgical trainees appear to learn the procedure rapidly, they must move beyond the initial learning curve before practicing laparoscopy [6] and to be able to deal more effectively with difficult cases, [26] as the concerns of safety for both surgeon as well as patient are present even after the passage of "learning curve" phase. [2,10,25,27]

Experience of the trainees for laparoscopic skills during dry laboratory provides trainees with significant exposure to the environment of laparoscopic cholecystectomy before they start wet laboratory the next day in a special operating room on a sheep to decrease potential errors.

Along with teaching, there should be some form of accreditation, [5] Winckel and colleagues have shown that the use of a checklist during observation of these procedures provided a reliable and valid tool for measuring technical skills. We used Eubanks et al. scoring system for LC [21] as example of Objective Structured Assessment of Technical Skills (OSATS) [28] , in which every error was scored as negative scoring , which may reflect the real status of the trainees skills in the procedure (table 2). For more realization of both subjective and objective evaluation of the skills and practice gained in the course, we distributed a questionnaire to the trainees at the end of the wet laboratories . To declare their opinion about how they experienced the procedure and how much skills and practice they have gained (table 3), This is in line to recommendation regarding accreditation ,which could be carried out at a convenient time by the mentor responsible for the feedback to the trainee and potentially by the trainees as a form of self-assessment. [5,15,16,21,26] Statistical analysis done to find the influence of age, duration of surgical residency, open and laparoscopic cholecystectomies done before the course by each trainee versus the accreditation scores of the trainees during the course , there was very strong evidence against the null hypothesis , which means there is no influence of this factors on the final scoring of the trainees (table 5) . One could notice that most of the trainees were inexperienced (who had not performed any LC s at all or had been the primary assistant for a minimum of five LC procedures). [12,17] in laparoscopy. They learned the procedure and improved their skills and became more familiar with LC (Table 3) .This is parallel to what is found in the literature that " inexperienced subjects are most likely to benefit from training". [7, 12, 15, 23, 24, 29]

One may notice from (table 3),that the trainees scored the titles of the course as (6-9),(7-10) and (7-9)scores from maximum of 10 scores for theoretical lectures ,videos ,dry laboratory on animated boxes and wet laboratory respectively .While degrees of fatigue scored from (4-7) from maximum (10 scores), and half of them felt fatigue up to 5 scores from maximum of 10 scores.Iit is well known that limitations of laparoscopic field leads to unnatural and painful surgical postures that result in fatigue for the trainees [15]

In the validation by the supervisor half of the trainees gained (70 -79) points , three quarter gained(65-79) points and the remaining gained 60-65 points .These points were reversely changing with the number and type of the errors ,which were noticed and recorded during wet laboratory . The most common error (83.3%) was injury to gallbladder, the next (58.3%) was unintentional cystic duct transaction and the rarest error (8.3%) was collateral injury to the stomach. All these errors were corrected by on spot feedback from the supervisor which helped in avoiding repetition of the error by the same trainee (table 2).

The overall time or the time it took for particular step have not put in the consideration in the accreditation, as "the speed–accuracy trade-off is a well-known phenomenon in motor control, in which speed increase cause decrease in accuracy and vice versa" and more accurate movements may take more time to complete. [15]

Female trainees were more motivated and conservative in selection of the type of laboratory, as they chose both dry and wet, and only they chose to be a surgeon with supervision (table 1), although there are studies claiming that gender will not affects the raining in surgical field [30,31] ,but many studies, showed that there are gender differences in the learning and gaining skills in surgical training , as females always need to rely on a supervisor during stress of training and have less spatail's ability(at tasks that require rotating an object mentally) than male, ,This make them need repeatation for similar outcomes from the training [27,29,32] to gain significant improvement of psychomotor skills.[23]

We could conclude that the knowledge based learning, a stepwise technical skills in curriculum II, with on spot feedback will teach practical skills for inexperienced surgical trainees .Bbut they need more training by clinical attachment and assisting in laparoscopy on real patients in the form of curriculum III to be qualified as laparoscopic surgeons. So it is better that training of laparoscopy to be incorporated as early as third year in to the curriculum of training programs for trainees of board of surgery, to give time for further training before qualification as surgeons.

CONCLUSION

Although the knowledge based learning, a stepwise technical skills in curriculum II, with on spot feedback will teach practical skills for inexperienced surgical trainees ,but they need more training by clinical attachment and assisting in laparoscopy on real patients in the form of curriculum III to be qualified as laparoscopic surgeons. So it is better that training of laparoscopy to be incorporated as early as third year in to the curriculum of training programs for trainees of board of surgery, to give time for further raining before qualification as surgeons.

AKNOWLEDEGEMENT

We would like to thank all the medical and paramedical workers in Hatwan Private Hospital, and trainees for their technical support; I thank dr Fazil Muhamas for his statistical analysis .

REFERRENCES

1. IEEE Systems and Information Design Symposium •University of Virginia K. Brook Green, Maranda S. Luniewski, Todd C. Mersch, Brian A. Mitchell, G. Reed Poole, Stephanie A. Guerlain, Reid Adams,. Forrest Calland,., and Ed G. Chekan,. VIDEO-BASED TRAINING FOR LAPAROSCOPIC SURGERY, 2002, 103-110
2. S. C. PATEL and J. R. BHATT, LAPAROSCOPIC CHOLECYSTECTOMY AT THE AGA KHAN HOSPITAL NAIROBI, East African Medical Journal Vol. 77 No. 4 April 2000
3. Sanjay K. Bhasin , J.G. Langer, Laparoscopic Cholecystectomy:An Experience of 200 Cases, JK SCIENCE, Vol. 6 No. 2, April-June 2004
4. Misra M, Schiff J, Rendon G, Rothschild J, Schwaitzberg S, Laparoscopic cholecystectomy after the learning curve: what should we expect, Surg Endosc.2005 Sep; 19(9):1266-71. 2005; 7, 21.
5. C M S Royston, M R J Lansdown, W A Brough , Teaching laparoscopic surgery: the need for guidelines BMJ 1994; **308** : 1023
6. Moore MJ, Bennett CL, The learning curve for laparoscopic cholecystectomy. The Southern Surgeons Club, Am J Surg, 1995 Jul; 170(1):55-9.
7. SO Cawich; DIG Mitchell; MS Newnham; M Arthurs, ,A comparison of open and laparoscopic cholecystectomy done by a surgeon in training,West Indian med. j. vol.55 no.2 Mona Mar. 2006
8. W. O. Kirwan, T. K. Kaar and R. Waldron, Starting laparoscopic cholecystectomy — The pig as a training model ,Irish Journal of Medical Science Volume 160, Number 8, 243-246
9. Pairolero Claude Deschamps, Mark S. Allen, Victor F. Trastek, Julie O. Johnson and Peter C.
Fundoplication Early Experience And Learning Curve Associated With Laparoscopic Nissen, J Thorac Cardiovasc Surg 1998;115:281-285
10. Peng-Sheng Lai, Yi-Chung Hou,Tung-Cheng Chang,Chi-Hsiang Hung,Hung-Mao Lin,Jin-Tung Liang The Learning Curve of Laparoscopic Colorectal Surgery in Regional Hospital,
J Soc Colon Rectal Surgeon (Taiwan) March 2010
11. Daniel W. Birch, Cliff Sample, and Rohit Gupta, The impact of a comprehensive course in advanced minimal access surgery on surgeon practice, Can J Surg. 2007 February
12. R. Aggarwal, P. Crochet, A. Dias, A. Misra, P. Ziprin and A. Darzi, Development of a virtual reality training curriculum for laparoscopic cholecystectomy, *British Journal of Surgery* 2009; 96: 1086–1093
13. Karl A. Zucker, Robert W. Bailey, Thomas R. Gadacz and Anthony L. Imbembo MD, Laparoscopic guided cholecystectomy**,** The American Journal of Surgery ,Volume 161, Issue 1**,** January 1991, Pages 36-44
14. D. Munday, J. Kerin , A Laparoscopic Surgical Training and Accreditation Program Up and Running, Australian and New Zealand Journal of Obstetrics and Gynaecology
15. Timothy N. Judkins Æ Dmitry Oleynikov Æ, Nick Stergiou, Objective evaluation of expert and novice performance during robotic surgical training tasks, Surg Endosc (2009) 23:590–597
16. T. P. Grantcharov, V. B. Kristiansen, J. Bendix, Randomized clinical trial of virtual reality simulation for laparoscopic skills training, British Journal of Surgery,Volume 91, Issue 2, pages 146–150, February 2004
17. LAPO BENCINI,MARCO BERNINI, FRANCESCO MARTINI,MICHELE ROSSI,MARCO FARSI, BERNARDO BOFFI, EGIDIO MIRANDA, LUCA MORALDI, RENATO MORETTI, Safety of laparoscopic cholecystectomy performed by surgical residents, Chirurgia Italiana, 2008 - vol. 60 n. 6 pp 819-824
Volume 39, Issue 4, pages 430–437, November 1999.

18. P K H Tam, Laparoscopic surgery in children, Arch Dis Child 2000; **82:240**-243
19. Pasqualucci, Alberto , De Angelis, Verena , Contardo, Riccardo , Colo, Francesca , Terrosu, Giovanni , Donini, Annibale , Pasetto, Alberto , Bresadola, Fabrizio, Preemptive Analgesia: Intraperitoneal Local Anesthetic in Laparoscopic Cholecystectomy: A Randomized, Double-blind, Placebo-controlled Study Anesthesiology: July 1996 - Volume 85 - Issue 1 - pp 11-20
20. Hunter JG, Sackier JM, Berci G,Surg Endosc. Training in laparoscopic cholecystectomy: Quantifying the learning curve ,1994 Jan;8(1):28-31.
21. Thomas R Eubanks, Ronald H Clements, Dieter Pohl, NoelWilliams, Douglas C Schaad, Santiago Horgan, Carlos Pellegrini, An Objective Scoring System for Laparoscopic Cholecystectomy, J Am Coll Surg, Vol. 189, No. 6, December 1999,566-574
22. Udaya Kumar and Inderbir S. Gill, Learning curve in human laparoscopic surgery Current Urology Reports ,Volume 7, Number 2, 120-124, DOI: 10.1007/s11934-006-0070-5.
23. Col PVR Mohan, Brig R Chaudhry,Laparoscopic Simulators : Are They Useful!, MJAFI, Vol. 65, No. 2, 2009
24. R. efr, J. Ochmann, Our experience with early integration of laparoscopic cholecystectomy in surgical residency training,, Surg Endosc (1995) 9:902-904
25. Soon Hwa Youn, Young Hoon Roh, Hong Jo Choi, , Young Hoon Kim, Ghap Joong Jung, and Mee Sook Roh,,The Learning Curve for Single-Port Laparoscopic Cholecystectomy by Experienced Laparoscopic Surgeon,J Korean Surg Soc. 2011 Feb;80(2):119-124.
26. Andrus J Voitk, The tail of the learning curve for laparoscopic cholecystectomy , The American Journal of Surgery,Volume 182, Issue 3 , Pages 250-253, September 2001
27. Brij B. Agarwalab,
Results of laparoscopic cholecystectomy without energized dissection: A prospective study, International Journal of Surgery, 167-172 (2010)
28. Richard Reznick, Glenn Regehr, Helen MacRae, Jenepher Martin, Wendy McCulloch,Testing technical skill via an innovative “bench station” examination, The American Journal of Surgery,Volume 173, Issue 3 , Pages 226-230, March 1997
29. Scott P. Johnson, Gender Gap In Spatial Skills Starts In Infancy, Psychologists Report, Science Daily, (Dec. 23, 2008)
30. Theresa M Wendel, MD, Constantine V Godellas, MD, Richard A Prinz,Are there gender differences in choosing a surgical career**?**, Surgery. Volume 134, Issue 4, Pages 591-596 (October 2003).
31. Magnus Anderberg, Johan Larsson, Christina C Kockum, Einar Arnbjörnsson, Robotics versus laparoscopy - an experimental study of the transfer effect in maiden users, Annals of Surgical Innovation and Research ,2010, 4:3
32. Janelle D. Yutzie,John L. Shellito, Stephen D. Helmer, Frederic C. Chang, The American Journal of Surgery,Gender differences in general surgical careers: results of a post-residency survey,Volume 190, Issue 6 , Pages 978-983, December 2005