

The Influence of Hands-On Laser Training on Usage of the CO₂ Laser

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A questionnaire was distributed to all participants in the Rochester General Hospital CO₂ laser training workshops for surgeons (1982 to January 1985). The results of this study indicate that, while laser training is necessary prior to being able to use the laser, only a small fraction of trainees actually use the laser in their clinical practice. Surgeons who are using the laser do so in a minority of their cases. New incentives for laser usage must be investigated.

Key words: laser, CO₂ laser, education, laser surgery

INTRODUCTION

Lasers have found numerous medical applications since their development by Maiman in 1960 [Maiman, 1960]. The CO₂ laser has proved to be a valuable addition to the armamentarium of the surgeon, with unique properties which enable the surgeon to cut, vaporize, sterilize, and seal. However, the CO₂ laser is an instrument requiring a thorough understanding of its principles and the acquisition of specially adapted surgical skills for its safe and proficient use.

Traditionally, surgical skills are acquired through the graded apprenticeship of residency. Yet very few programs prepare the general surgeon for the use of the laser. Laser training is usually provided via seminars with both didactic and laboratory experiences for the participants. This study was undertaken to determine the ability of a hands-on CO₂ laser training course to influence laser usage among course graduates.

MATERIALS AND METHODS

In order to answer this question, a standardized questionnaire (Table I) was distributed to all those who had participated in the hands-on laser workshops at the Rochester General Hospital through January 1985. From 1982 through January 1985, 18 workshops were offered at Rochester General. Each one-day workshop admitted a maximum of 15 participants. The format of these workshops is shown in Table II. The morning session consisted of lectures on laser physics, tissue effects, laser

safety, clinical applications, and a brief introduction to the instrument. In the afternoon, the participants were introduced to the instrumentation and were given a brief demonstration of laser functions and techniques. They were then divided into small groups, each supervised by trained faculty, and allowed to proceed with the laboratory exercises at their own pace. Each trainee gained a graded hands-on experience with objects such as tongue blades, acrylic blocks, oranges, and then performed procedures on chicken parts prior to actual surgery on small animals (rats, rabbits). Microsurgical and scanner exercises were demonstrated and participants were allowed to perform tasks designed to provide a basic understanding of these techniques. Videotapes and literature were available to course participants at all times throughout the workshop.

RESULTS

The questionnaire was distributed to 173 course participants. There were 115 respondents (66.5%), although each respondent did not answer all questions. The results are listed in Table III.

Eighty-six (74.8%) of the responders were attending surgeons at the time they sought laser training. The balance was either residents, nurses or support personnel. Seventy-two (62.6%) were general or plastic surgeons.

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TABLE 1. Sample Questionnaire Distributed to Participants: The Effect of Laser Training Courses on Surgical Practice

1. Sex
M (1) F (2)
2. Age
25-30 (1) 41-45 (4)
31-35 (2) 46-50 (5)
36-40 (3) > 50 (6)
3. Type of practice
Solo (1)
Group (2)
Institution (3)
Full-time academic (4)
Other (5)
4. Location of practice
Rural (1)
Town (2)
Small city 50K (3)
City 50K-300K (4)
Large urban 300K (5)
5. Type of institution you are primarily affiliated
Private hospital or clinic (1)
Community hospital (2)
University hospital (3)
Veterans administration (4)
Military (5)
Other (6)
6. Does the above named institution have a general surgery residency program?
Y (2) N (1)
7. Does the above have research facilities?
Y (2) N (1)
8. The institution named in 5 has _____ CO₂ lasers.
1 (1) 5 (5)
2 (2) 6 (6)
3 (3) 7 (7)
4 (4) Currently negotiating purchase (8)
9. Did your institution buy a laser as a result of this course?
Y (2) N (1)
10. Did the hospital have other types of lasers in use?
Y (2) N (1)
11. If yes, please enter how many there are of each.
Argon (1) ()
Argon/Dye (2) ()
Nd/YAG (3) ()
Other (4) ()
12. What is the maximum power output of the CO₂ laser(s) which you have available for use?
15W (1) 60W (5)
25W (2) 80W (6)
30W (3) 100W (7)
40W (4) Other (8)
13. Has the equipment been satisfactory? Y (2) N (1)
If you answer no, please briefly list the problems on the reverse side.
14. I took the RGH laser course _____ ago.
6 months (1)
6 months-1 year (2)
1 year-2 years (3)
2 years (4)
15. At the time you took the laser course were you a
Medical student (1)
Intern (2)
Resident (3)
Chief Resident (4)
Fellow (5)
Attending (6)
Chief of Surgery (7)
16. Please designate your primary specialty area
General surgery (1)
Vascular surgery (2)
Otolaryngology (3)
Urology (4)
Orthopedics (5)
Plastic surgery (6)
Colorectal surgery (7)
Gynecology (8)
Neurosurgery (9)
Other (10)
17. At the time you took the RGH course, were you using a CO₂ laser in your practice?
Y (2) N (1)
18. Have you taken other CO₂ laser courses either prior to or following the RGH course?
Number of courses (fill in number)
Y (2) N (1) Prior: ()
Y (2) N (1) Following: ()
19. About how many laser cases have you done since taking the RGH course?
0-10 (1) 51-75 (4)
11-25 (2) 76-99 (5)
26-50 (3) > 100 (6)
20. About what percentage of your operative procedures are done at least in part with the CO₂ laser?
(Please list those cases which you felt the laser particularly useful on the reverse).
0-10 (1) 51-75 (4)
11-25 (2) 76-99 (5)
26-50 (3) > 100 (6)
21. When you do use the laser, is it applied (circle all which apply)
Free-hand (1)
Microscope/micromanipulator (2)
Scanner (3)
Endoscopic (4)
22. Do you feel that attendance at this or a similar course was necessary prior to using the CO₂ laser?
Y (2) N (1)
23. Does your hospital require CME training courses prior to obtaining laser surgery privileges?
Y (2) N (1)
How many hours are required?

24. Was the course suited to your particular needs?
Y (2) N (1)
25. Were other courses necessary before you felt comfortable in using the laser clinically?
Y (2) N (1)
26. Did you perform other laboratory laser exercises prior to using the laser clinically?
Y (2) N (1)
27. Would you have preferred an additional half-day laser lab with the RGH course?
Y (2) N (1)
28. What areas do you feel could be improved in our or other training courses? (Please list on reverse side.)
29. Please list any books or papers on the reverse which you have found particularly useful.

Thank you for your cooperation

Optional

Name _____

Institution _____

TABLE II. Outline of Workshop Curriculum: CO₂ Lasers in Surgery Agenda

Morning session	
8:30 a.m.	Registration
	Introduction
	Laser physics
	Power densities
10:15 a.m.	Break
	Tissue effects
	Clinical applications
	Laser safety
12:15 p.m.	Lunch
Afternoon session	
1:00 p.m.	Library/Animal Lab
	Operation of laser
	Demonstration of laser
	Practical session (hands-on)
	with laser in Animal Lab
5:00 p.m.	Evaluations and adjournment

TABLE III. Questionnaire Results

	n	%
Number questioned	173	100
Number of respondents	115	66.5
1. Sex		
Male	100	87.0
Female	9	7.8
N/A	6	5.2
2. Age		
25-30	10	8.7
31-35	11	9.6
36-40	18	15.6
41-45	23	20.0
46-50	12	10.4
> 50	37	32.2
N/A	4	3.5
3. Type of practice		
Solo	32	27.8
Group	51	44.3
Institution	5	4.3
Full-time academic	9	7.8
Other	12	10.4
N/A	6	5.2
4. Location of practice		
Rural	3	2.6
Town	6	5.2
Small city	8	7.0
City 50K-300K	53	46.1
Large urban 300K	38	33.0
N/A	7	6.1
5. Primary affiliation		
Private hospital or clinic	25	21.7
Community hospital	53	46.1
University hospital	32	27.8
Veterans administration	0	0
Military	1	0.9
Other	0	0
N/A	4	3.5
6. Does institution have residency training?		
No	32	27.8
Yes	76	66.1
N/A	7	6.1
7. Does institution have surgical research facilities?		
No	32	27.8
Yes	76	66.1
N/A	7	6.1
8. Number of CO ₂ lasers at institution		
0	6	5.2
1	52	45.2
2	27	23.5
3	13	11.3
4	1	0.9
Negotiating purchase	5	4.3
N/A	11	9.6

9. Buy a laser as a result of this course (institution)?			18A. CO ₂ training taken prior to RGH		
No	92	80.0	No	102	86.1
Yes	11	9.6	Yes	6	5.2
N/A	12	10.4	N/A	7	6.1
10. Does hospital have other types of lasers?			18B. CO ₂ training taken after RGH		
No	43	37.4	No	76	66.1
Yes	58	50.4	Yes	7	6.1
N/A	14	12.2	N/A	32	27.8
11. Types of lasers?			19. Number of laser cases since training?		
Argon	28	24.4	0-10	86	74.8
Argon/Dye	3	2.6	11-25	16	13.9
Nd/YAG	14	12.2	26-50	4	3.5
Other	10	8.7	51-75	2	1.7
None	24	20.8	75-99	1	0.9
N/A	36	31.3	100	2	1.7
12. Wattage of CO ₂ laser available?			N/A	3	2.6
15W	1	0.9	20. Percentage of OR cases done with laser?		
25W	2	1.7	0-10	90	78.3
30W	1	0.9	11-25	13	11.3
40W	14	12.2	26-50	0	0
60W	7	6.1	51-75	2	1.7
80W	37	32.2	76-99	0	0
100W	3	2.6	100	1	0.9
Other	6	5.2	N/A	9	7.8
N/A	44	38.3	21. How laser is applied in surgery?		
13. Is your equipment satisfactory?			Free-hand	61	53.0
No	6	5.2	Microscope/micromanipulator	14	2.2
Yes	72	62.6	Scanner	2	1.7
N/A	37	32.2	Endoscopic	5	4.3
14. How long ago was course taken?			N/A	33	28.7
6 months or less	26	22.6	22. Was training necessary prior to using CO ₂ laser?		
6 months-1 year	31	27.0	No	5	4.3
1-2 years	36	31.3	Yes	102	88.7
2 or more years	16	13.9	N/A	8	7.0
N/A	6	5.2	23. Does hospital require training prior to use of laser?		
15. Status at time course was taken?			No	14	12.2
Med student	6	5.2	Yes	79	68.7
Intern	3	2.6	N/A	22	19.1
Resident	12	10.4	23A. Number of CME hours required?		
Fellow	1	0.9	0-10	27	23.5
Attending	75	65.2	11-15	0	0
Chief of Surgery	11	9.6	16 or more	2	1.7
Nurse	3	2.6	N/A	86	74.8
N/A	4	3.5	24. Was RGH course suited to your needs?		
16. Primary specialty			No	16	13.9
General surgery	52	45.2	Yes	93	80.9
Vascular surgery	3	2.6	N/A	6	5.2
Otolaryngology	7	6.1	25. Were other courses necessary before you felt comfortable with the laser?		
Urology	4	3.5	No	77	67.0
Orthopedics	8	7.0	Yes	18	15.7
Plastic surgery	11	9.6	N/A	20	17.4
Colorectal	6	5.2	26. Did you do more laser lab training prior to clinical work?		
Gynecology	1	0.9	No	70	60.9
Neurosurgery	4	3.5	Yes	32	27.8
Cardiothoracic	2	1.7	N/A	13	11.3
Pediatrics	4	3.5	27. Would an additional 1/2-day lab have been preferred?		
Podiatry	2	1.7	No	53	46.1
Radiology	2	1.7	Yes	48	41.7
N/A	9	7.8	N/A	14	12.2
17. Were you using CO ₂ laser prior to RGH course?					
No	99	86.1			
Yes	9	7.8			
N/A	7	6.1			

A small minority of those responding (5, 4.3%) felt that a training seminar was not necessary prior to using the laser. However, 110 (95.7%) indicated that some training was indeed a prerequisite to using the laser clinically. The majority of the respondents (102) had not participated in any laser training course prior to the RGH experience, while only seven students (6.1%) indicated that they had taken other courses since attending the RGH workshop. Seventy-six (66.9%) participants did not seek further training and 32 (27.8%) failed to answer this question entirely.

The majority of the respondents (98, 85.2%) practiced in institutions with at least one CO₂ laser available for their use. However, 90 (78.3%) indicated that they used the laser less than 10% of the time, and 13 (11.3%) stated that they used the laser between 11 and 25% of the time. Only six (5.2%) used the laser in 25% or more of their clinical cases.

Eighty-six (74.8%) of the respondents performed less than ten procedures with the laser, and 16 (13.9%) performed 11 to 25 cases since the RGH course. Only ten respondents (8.6%) performed more than 25 procedures with the laser.

As expected, 61 respondents (53%) indicated that they tended to use the laser free-hand when they performed surgery. This response was predictable since the majority (62.6%) of the course participants classified their specialty as being primarily general and plastic surgery.

While only 18 (15.7%) felt that other courses were not necessary before they would be able to use the laser comfortably, 48 (41.7%) indicated that they would have preferred an additional half-day laboratory session with our current 8-hour seminar.

DISCUSSION

The questionnaire is a valid tool for establishing the opinion of a group regarding a specific topic. Data accrued from such methodologies will depend upon the proportion of respondents to the population polled. Thus, we are pleased that 66.5% did respond to the questionnaire and are confident that the data reported above is truly reflective of our course trainees.

Our results demonstrated that hands-on training is indeed necessary for the use of the laser. Since this training is not widely available during the surgical residency, it is fitting that workshops be available for those wishing training. Our data indicate that very few students

availed themselves of other courses prior to our own (13) and only seven (6.1%) sought further training after attending our seminar. It is, therefore, most important that the laser seminar provide an adequate experience for the trainee, particularly if other laboratory experience is not available.

Only a few of those who have been trained are using the CO₂ laser in their clinical practice. Further, those who are using the laser, do so in a minority of their case load. While at first glance these results are disconcerting, they do coincide with the experience at our own institution. Rochester General Hospital has trained approximately 40 attending surgeons and gynecologists and has three lasers available for use. Yet, only three surgeons use the laser with any regularity, and another five surgeons have used the laser one or more times. In addition, even the most avid laser users at RGH perform between 11 and 25% of their procedures with the laser. We agree with Brown and Cerullo [1984] that such figures indicate a selectivity on the part of surgeons with regard to cases for which use of the laser is applicable. However, our results also demonstrate a reluctance on the part of surgeons to use new technologies in the performance of procedures.

It has been our experience that only a handful of surgeons are willing to adapt their surgical techniques to accommodate the use of the laser, despite its numerous advantages. Much work must be done to educate general surgeons in regard to the advantages and clinical applications of the CO₂ laser in surgery. New incentives for laser usage must be investigated and new means sought which would facilitate the use of the laser in routine surgical procedures.

Equipment costs and third party payments for the use of the laser were not specifically addressed by this study. However, such extrinsic factors do play a significant role in the surgeon's decision either to use or not use the laser in a given case.

It is clear that laser education is essential and must continue to evolve as demand for such training increases.

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