

MY EXPERIENCE OF TEACHING PHACOSURGERY ON VISALIS 100 IN SUDAN AND NIGERIA

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Abstract

At the invitation of the director of The National Eye Center, Kaduna, Nigeria and The Makkah Eye Hospital of Khartoum, Sudan I visited both these institutions to teach phacoemulsification surgery to their aspiring surgeons on Visalis 100 (Carl Zeiss Meditec, Germany).

This article highlights the experience of teaching phacoemulsification surgery in foreign African countries like Nigeria and Sudan. In Nigeria I had the opportunity to give training in both wet lab and live surgery settings whereas in Sudan only hands-on live surgery.

Sudan being an Islamic nation pigs are not slaughtered there and hence no pig eyes. Goat eyes differ significantly from human eyes and hence have almost no value in wet lab teaching.

The training program included theoretical discussions, wet lab, surgery and finally discussions related to the days' surgery. It became clear that quality of learning depends on three main factors.

Thorough understanding of theory and observation of senior surgeons in operation room

Good wet lab and finally doing the surgery oneself in step by step manner.

Dedicated teachers and instructors can make all the difference.

The learning curve also significantly shortens if the trainees are exposed to all types of cataract surgery like ECCE, SICS and phacoemulsification surgery. The main problem faced by those surgeons who have done only ECCE/SICS is that they are not used to handling microscope and instruments in both hands at the same time. Hence I strongly recommend them wet lab where they can sit and practice using both hands and feet and microscope simultaneously and in coordinated fashion.

Keywords: Learning curve, CCC., S.I.C.S., phacoemulsification machines, Ultrasound delivery modes

Introduction

Learning phacoemulsification surgery for cataract is desired by every ophthalmology resident in the world. Every ophthalmology

resident wants to learn this technique and master it by the time he/ she plans to endeavor into private practice.

The history and evolution of this technique has run almost parallel with the technique of

laparoscopic surgery and certain dental procedures like ultrasonic removal of dental calculi [1] and at the same time borrowing a few concepts from them both.

In fact, phacoemulsification procedure owes its existence to dentistry.

Like every new thing, learning phacoemulsification also has three distinct phases.

1) Phases of fear: I AM GOOD FOR NOTHING phase

2) Phase of excitement: HELL I AM ACTUALLY DOING IT phase

3) Phase of adaptability: I AM COOL BUT COULD DO BETTER phase

What is a learning curve?

The earliest definition of the learning curve as given by the psychologist Hermann Ebbinghaus in 1885 states that: Progress in learning steps plotted against time is the learning curve [2]. In other words, a graphical representation of the time it takes to learn all steps of a said procedure.

The application of the learning curve was first introduced in the aviation industry [3].

However, it can be applied to any learning procedure.

On what factors is a learning curve of phacoemulsification surgery dependent on?

Intrinsic factors like:

- 1) Tech savvy or not
- 2) Age (?) debatable
- 3) Peers pressure
- 4) Instructors
- 5) Previous surgical experience
- 6) Possibility to put this learning into practice.

Extrinsic factors like:

1. If the trainee surgeons has undergone training on all evolutionary stages of cataract surgery like ECCE --> SICS--> PHACO

2. In phacoemulsification surgery DIVIDE & CONQUER --> STOP & CHOP --> PHACO CHOP

3. Confidence of trainees increases when they are given reliable, safe and a simple machine to get trained on.

4. Confidence is also inversely proportional to the number of complications created during the learning cases. The less the complication

during this time, the more is the confidence to travel further.

What is a reliable machine?

A reliable phacomachine should fulfill the following criteria:

1. which has good aspiration pump
2. whose phaco hand piece is ergonomic in design and light weighted
3. whose ultrasound delivery is predictable
4. which comes with the wide range of needles and sleeves to choose from
5. which has good surge controlling mechanism (pressure sensors)
6. I/ A parameters safe for removal of visco elastic material from the eye.

In Nigeria and Sudan I was asked to give training on Visalis100 (Carl Zeiss Meditec GmbH, Germany) phacomachine.

I found Visalis100 best suited to carry out phaco-training for beginners because of the following technical specifications:

I. **Aspiration pump:** Visalis100 uses a peristaltic pump. For beginners this is the safe cushion. It offers vacuum buildup of up to 500mmHg and a flow rate of up to 50 cc/ min.

II. **Rise time adjustment:** The pump ramp can be controlled from as fast as 0.5 sec to as slow as 12 sec, depending upon the preference of the user and the use case. It makes sense for beginners to set a rise time on slower side. At very fast settings, you will get venturi effect of the peristaltic pump.

III. **Ultrasound delivery system:** In this machine, it is expressed in terms of micrometers of the stroke length of the needle. It is calibrated to work between 0-100 μ . The modulation of the ultrasound can be programmed in continuous, pulsed, multi burst and continuous burst modes. The pulsed mode can be further modulated to High (50% duty cycle), Medium (16ms ON time) and Low (8ms ON time) modulations for any selected pulse frequency.

IV. **Adaptive Power Control** is a feature, which optimizes ultrasound use irrespective of hardness of the nucleus.

V. **Foot Control Panel** can effectively control the choice of single linear or dual linear operation. The foot pedal design is ergonomic and user friendly.

VI. **Warning sounds and enhanced safety alarm system** prevents unintended changes

from being applied. For example if the vacuum is increased by more than 30% of preset even when the foot control panel is active, then the machine sends out warning sounds and message and only after clicking the OK button does the change actually apply.

VII. **Surge effect** is minimized due to S3 (i.e. surge security system). The S3 delays the restart of the pump exponentially after the occlusion break occurs.

VIII. **Phaco tips** are titanium and available in straight, angled, flared and biconical shapes. Gauge 19G, 20G and 21G.

IX. **Anterior Vitrectomy** can be done by using pneumatic cutters with a maximum cut rate of 700/ min. in single cut or multiple cut option also delivered in linear and dual linear foot control pedal. An inbuilt compressor provides the necessary compressed air. However, it is not useful for doing posterior vitrectomy.

In 2013, I was invited by the Director of The National Eye Center, Kaduna Nigeria and in 2014 by the Director of The Makkah Eye Complex, Khartoum Sudan to train their ophthalmologists.

I was given a group of 4 surgeons from Nigeria and 4 from Sudan.

The machine given was Carl Zeiss Meditec's Visalis 100, Operating Microscope Carl Zeiss Visu- 160 in Sudan and Nigeria (Also two microscopes Leica F8 and Lumera T from Carl Zeiss).

The Nigerian surgeons were first introduced to the wet lab by using the same machine. The Sudanese surgeons did not have such an opportunity due to religious reasons.

The teaching was classified in three parts.

1. Theoretical discussions.

2. Wet lab to perform the machine independent steps like making tunnel, CCC, hydro-dissection, chopping and IOL implantation. The IOLs implanted during wet lab were mainly foldable IOLs of Indian making.

3. Wet lab to perform the machine dependent steps like trenching, aspiration of the nucleus (in pig eyes no cataract was present) and removal of visco-elastic material from the eye and practicing bimanual Irrigation/ Aspiration.

4. Practical training in operation theatre was carried out every day. On an average, each

trainee surgeon operated 20 cases (80 cases in each institute).

5. Both in Sudan and in Nigeria the patients were mature cataracts. Very few were immature cataracts.

6. Chopping presented a challenge for beginners due to this fact.

7. The main complication that occurred in both countries equally, was nucleus "drop".

8. The availability of the vitreo-retinal surgeon in both institutes made it easy to address this complication.

9. Corneal burn occurred only in one case in Sudan.

Table 1. Comparison of training parameters in NEC and MEC

PARAMETERS	NIGERIA NEC	SUDAN MEC
1. Number of trainees	4	4
2. Median age of the trainees	32	35
3. Gender wise distribution	3 Men 1 Woman	3 Women 1 Man
4. Previous surgical experience	ECCE (3)SICS(1)	ECCE (3)SICS(1)
5. Previous experience of doing CCC Using cystitome/rhexis forceps	1 surgeon well conversant	All 4 surgeons well conversant
6. Basic understanding of the machine	Theoretical	Theoretical
7. Time taken for CCC on average	60-90 sec	45-60 sec
8. Making tunnel were graded		
1. Good		
2. Moderately good	2	3
3. Very good	1	1
4. Poor	1	-
Depending on leakage presence, shape of the tunnel and length of the tunnel into the corneal tissue.		

9.	Hydrodissection was graded		
	1. Good	2	1
	2. Very Good	1	2
	3. Fair	1	1
	Depending upon the number of attempts taken by the surgeon.		
10	Trenching gradation was dependent on the nuclear sclerosis grading.		

Table 2. Comparison of complications in both institutes

COMPLICATIONS	NEC (KADUNA) NIGERIA	MAKKAH EYE COMPLEX KHARTOUM
NUCLEUS DROP	03	04
CORNEAL BURN	00	01
P.C. RENT	09	11
EXTENDED CCC	10	12
LEAKING TUNNEL	02	04
NEED FOR SUTURING	10	11
CONVERT TO SICS	10	11

What is the rational behavior?

Definition

A decision making process that is based on making choices that result in the most optimal level of benefit for the individual [5]. That means making decisions that turn out to the benefit of the patient in the end. This Right decision is based on a previous experience like reading, seeing others and making mental record for future reference, remembering similar situations while doing surgery by oneself, etc.

Conclusion

In conclusion, let me highlight the following points:

1. Use machine for training that is less intimidating like the Visalis100 or its analogues.
2. Undergo wet lab training before starting surgery on patients.
3. See as many videos (especially with commentary) of other surgeons.
4. Watch senior surgeons or colleagues perform.
5. It makes sense to see videos of ECCE, SICS and all methods of phacoemulsification surgery.
6. Be vigilant in observing the complications and the way others came out of that situation.
7. Learning curve is independent of gender and age of the trainee surgeon.
8. Learning curve is shorter in persons who are tech savvy or open minded to technology.
9. Learning curve is definitely short for those trainees who have dedicated instructors by their sides during learning.
10. Stress on the trainees is markedly less when there is a vitreo retinal surgeon available in the institution.
11. Patient selection for training cases is important. Try to choose cataracts with a sufficiently hard nucleus but prefer not to choose very hard nucleus.
12. Use Step-By-Step method. That is doing the same step in as many patients as possible before proceeding to the next step. That way you can master each step thoroughly.
13. Do not be afraid of complications. They are going to happen no matter how advanced your career is. Even the most experienced surgeons encounter them.
14. Record your surgery and play videos at home repeatedly to see where you lack.

Conflict of interest

Declaration

The author has no financial or commercial gains from the company Carl Zeiss Meditec from Germany.

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