



An Affordable Laparoscopic Surgery Trainer for Trainees in Poor Resource Settings

Un appareil simulateur de chirurgie laparoscopique abordable pour des étudiants d'institutions à ressources limitées

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ABSTRACT

BACKGROUND: Laparoscopic surgery requires acquisition of new skills such as hand eye coordination of instruments whose working tips can only be seen in two dimensions on a monitor screen and depth perception. Simulators have been demonstrated as necessary to acquire these skills safely. However these simulators are expensive and not readily available in developing countries.

METHODS: I describe a cheap homemade adaptation of a laparoscopic trainer using a polyethylene fluid container, a webcam and a laptop computer as a monitor. This simulator can be easily be assembled by any surgical resident for use in his private time.

CONCLUSION: This simulator for laparoscopic surgery is cheap and can be readily assembled. A major limitation is the fixity of the camera which limits the working area to within ten to thirty centimeters of the camera. On the contrary the inability to alter the camera position eliminates the need for an assistant to hold the camera. *WAJM 2012; 31(1): 63–65.*

Keywords: Laparoscopic trainer

RÉSUMÉ

CONTEXTE: La chirurgie laparoscopique requiert l'acquisition de nouvelles aptitudes telles que la coordination main-yeux; des instruments dont les bouts opérationnels ne sont visibles qu'en bi dimensionnel sur l'écran d'un moniteur et une perception de la profondeur. Il est démontré que les simulateurs sont nécessaires à l'acquisition de ces aptitudes en toute sécurité. Toutefois ces simulateurs coûtent cher et ne sont pas encore disponibles dans les pays en développement.

MÉTHODES: Je décris un modèle maison adapté et pas cher de simulateur laparoscopique utilisant un container de polyéthylène fluide, une caméra web, et un ordinateur portable comme moniteur. Ce simulateur peut être facilement assemblé et utilisé par n'importe quel interne de chirurgie dans ses moments privés.

CONCLUSION: Ce simulateur pour la chirurgie laparoscopique n'est pas cher et peut être aisément assemblé. Une limitation majeure est la fixité de la caméra qui limite l'espace de travail à 10–13 centimètres de la caméra. A l'opposé, l'impossibilité à bouger la caméra élimine la nécessité d'un assistant pour tenir la caméra. *WAJM 2012; 31(1): 63–65.*

INTRODUCTION

Laparoscopic surgery requires special skills which differ from open surgery such as spatial orientation, loss of tactile feedback and three dimensional orientation on a two dimensional screen.¹ This makes it necessary to develop specialised ways of learning laparoscopic surgery. These skills are subsequently safely transferred to live surgery. Acquisition of operative skills in the clinical setting is constrained by the complexity of procedures, medico legal and ethical concerns and time limitations. This has created the need for formal training outside the operating room.² Virtual laparoscopic simulators have no limitations of time, or risks unlike conventional methods of training, which could jeopardize the health and even the lives of patients.³ Laparoscopic trainers are therefore designed to assist laparoscopic surgeons in skills acquisition.⁴ These trainers are expensive and they are often installed in departmental skills laboratory with limited access time for residents. Many simulators have been described in recent times with various limitations. There are some desired features in a good simulator. These include a rigid and robust body with contours mimicking the human torso which serves as a fulcrum for the working instruments and ports which allow a reasonable freedom of movement.⁵ Majority of simulators are suitable for the dry laboratory and are not suitable for offal and wet materials. The aim of this article is to describe the design of a cheap and easily constructible laparoscopic trainer for the surgical resident.

METHODS

The total cost of required material is less than five thousand naira (34 dollars). It is assumed that the average surgical resident has a functional windows XP compatible laptop.

1. The box is a recycled twenty five liter polyethylene container (keg) with a length of forty five centimeters and width and depth of twenty six and twenty four centimeters respectively. A twenty centimeter long flap opening is made to gain access to the interior aspect of the trainer (Figure 1). Rectangular

holes (0.5cm x 1cm) are made on both lateral walls of the simulator at the proximal end of the container about two to five centimeters from the end of the keg about fifteen centimeters from the floor of the simulator. A thirty centimeter ruler sits across these holes on which the camera is anchored. The 3 megapixel camera

is attached midway on the ruler described above to overlook the floor of the simulator. The webcam is connected to a lap top computer (Figure 1).

2. The port sites are two pairs of holes of one centimeter diameter each on the left and right margins of the proximal aspect of the trainer. These holes should be not less than one centimeter from the lateral margins of the polyethylene container and about five centimeters in front of the camera with a minimum distance of fifteen centimeters between the right and left sets of port sites for ergonomics. The one centimeter diameter is preferred to allow for easy movement for the instruments while at the same time utilizing the edge of the port as a fulcrum.
3. The floor of the interior of the 'trainer' consists of a plywood board or thick rubber sheet on which the offal can be pinned. This can be removed and washed.
4. The laptop computer screen which serves as monitor for the training surgeon sits on the distal part of the simulator. The placement of the trainer is made in such a way for the convenience of the surgeon (Figure 2). The low energy light source generates minimal heat. The quality of the image while performing the match box test is shown in Figure 3.

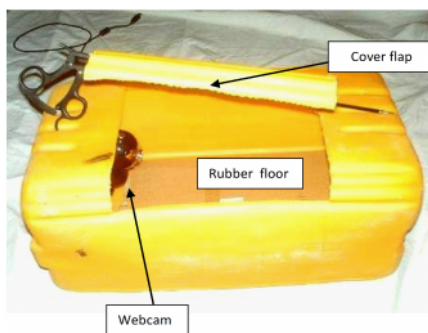


Figure 1.



Figure 2.

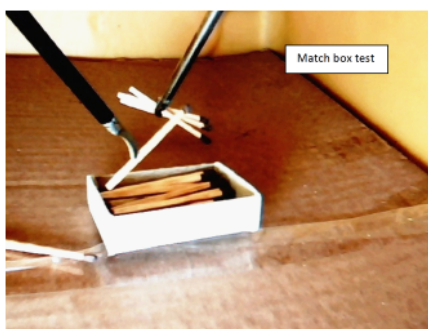


Figure 3.

DISCUSSION

Trainee surgeons need to have regular sessions on laparoscopic trainers. Many of these sessions may be after regular office hours when the usual laparoscopic surgery simulators are not available. A cheap laparoscopic surgery trainer has been described. It has been used for simple procedures for hand eye coordination and suturing techniques in trainee surgeons. It can be constructed easily within two hours and used for both dry and wet specimens. It is cheap however on the assumption that every surgical resident has a laptop computer. One disadvantage is working within a fixed range from the webcam lens but despite this there is clarity of the images

within ten to thirty centimeter range in the webcam field. On the contrary the inability to alter the camera position eliminates the need for an assistant to hold the camera.

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