Flying Solo – a pilot study of Day Case Robot Assisted Laparoscopic Surgery

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Abstract

Aim: To assesses the feasibility of using a robot camera positioning device (EndoAssist ™) in the day case setting for the laparoscopic repair of inguinal hernia.

Methods: Twenty consecutive patients underwent surgery using EndoAssist (n=10) or a human assistant (n=10) to operate the camera. Demographic data and operating times were recorded.

Results: There was no statistically significant difference in the overall mean operating times of the EndoAssist and Human Assistant groups (73 v 76 minutes p= 0.71).

Conclusion: Day case robot assisted laparoscopic surgery is feasible and safe. There is no associated lengthening of the operating time and may indeed free up valuable personnel for more productive work.

Keywords: Laparoscopic hernia repair; Robot; Day case.

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Introduction

Minimally invasive surgical techniques have acquired indisputable importance in modern general surgery. Ideally, the principal surgeon should have control of the visual field during laparoscopic surgery but invariably this depends upon an assistant who holds and manoeuvres the camera. This surrogacy of control can distort the surgeon's observations and disturb hand-eye coordination, particularly if the assistant is unfamiliar with or uninterested in the operative procedure.

The advent of robotic technology in surgery has led to the development of novel positioning devices, potentially eliminating the need for an assistant to operate the camera [1]. EndoAssist ™ (Prosurgics Ltd, High Wycombe, UK) is a free-standing robotic laparoscopic camera holding device that operates under surgeon control, utilizing a head motion tracking system (Fig. 1). An alternative robotic camera positioning device, AESOP ™ (Computer Motion, USA), responds to the surgeon's verbal commands. This system needs to be secured to the operating table prior to surgery, requires each surgeon to have an individual voice card and has the potential for background noise to result in voice recognition errors. Furthermore, comparison of these two systems in controlled simulated environments has shown that EndoAssist was significantly quicker at completing both simple and complex tasks [2]. The investigators concluded that this reduction was as a result of greater accuracy and a reduced number of erratic movements seen with the EndoAssist system.

We present the findings of our Phase I study to assess the feasibility of using EndoAssist in a day case setting for the laparoscopic repair of inguinal hernia. Inguinal hernia repairs constitute approximately 80,000 completed consultant episodes, 90,000 bed days and 38,000 day case procedures each year in England and Wales alone [3]. Although the majority of inguinal hernias are repaired using an open mesh technique, there is a continuing increase in the number of laparoscopic repairs performed since its introduction using mesh in 1991 [4].

Figure 1 EndoAssist Camera Positioning Robot.

Methods

Twenty consecutive patients underwent elective laparoscopic inguinal hernia repair as a day case procedure performed by a single surgeon. Ten of these operations were performed using EndoAssist as the sole assistant, with the remainder employing a human assistant to operate the camera. For robot assisted operations the free-standing EndoAssist device is positioned on the opposite side of the patient to the surgeon. The device is centred on the camera port using laser alignment and the laparoscope is then attached using a re-usable sterilised positioning arm. The device has 3 axes of movement centring on the entry point (pan, tilt and zoom). The surgeon wears a headmounted optical transmitter and direction of head movements are detected by a sensor mounted on the laparoscopic viewing monitor. Movement of the robotic arm, and hence camera, in the desired direction is then initiated and terminated by foot pedal control. Total operating times for each case were recorded; this included robot set-up time for EndoAssist cases. Demographic details of each patient were also collated. Data analyses were performed using a two-tailed Students t-test.

Results

All cases were completed successfully without any complications and patients were discharged home the same day as the procedure. Both groups were predominantly comprised of men with no significant difference in the mean age (p= 0.93) (Table 1). Robot set-up times varied from 4–9 minutes for EndoAssist ™ cases. The mean total operating time was 73 minutes (Standard deviation 23 minutes) for the EndoAssist group and 76 minutes (Standard deviation 27 minutes) for the Human Assistant group (Table 1). There was no statistically significant difference in the overall operating times between these two groups (p= 0.71).

Table 1 EndoAssist ™ versus Human Assistant.

	EndoAssist™ (n=10)	Human Assistant (n=10)
Male:Female	9:1	10:0
Mean Age (Range)/years	59 (37–77)	58 (37–84)
Mean Total operating time (Range) / minutes	73 (44–94)	76 (55–95)

Discussion

There is no doubt that the assistance received by the surgeon during laparoscopic surgery is extremely important. Human assistance is costly and does not always provide a stable platform for the laparoscopic camera. The introduction of robots in laparoscopic surgery was described by Begin et al in 1995 and used to safely perform three laparoscopic cholecystectomies [5]. Considerable progress has been made in robotic technology and more recent studies have demonstrated the benefits of substituting the human camera-holder with a robot. Aiono et al randomised patients undergoing laparoscopic cholecystectomy to either robot or human assistant [6]. There was a statistically significant reduction in the operating time when using EndoAssist of the order of 10%. Furthermore this work demonstrated a short and readily achievable learning curve of three cases to replicate the operating times of human assistant procedures.

There are clear limitations of this study with particular reference to sample size and lack of randomisation. However, this study has shown that robot-assisted laparoscopic inguinal hernia repair is feasible and can be performed safely in a day case setting. Furthermore, the timing data for robot assisted procedures includes initial learning curve cases without any pre-familiarisation period. Robot set-up was quickly acquired by theatre staff and even when including this additional time there was no significant difference in overall operating times for robot versus human assistant cases. Furthermore, with recent changes to medical and nursing work practices, the need for an assistant has obvious resource implications, preventing personnel being allocated to more appropriate duties.

Conclusion

Laparoscopic inguinal hernia repair can be performed safely using the EndoAssist robotic camera positioning device. Using this device does not appear to prolong the operating time and may free up valuable personnel for more productive duties appropriate to their training. This feasibility study has formed the basis of an ongoing randomised controlled trial to assess whether using EndoAssist can indeed result in a reduction in the operating time of laparoscopic inguinal hernia repairs.

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