Robotic right hemicolecotomy with D3 lymphadenectomy and complete mesocolic excision: technical detail

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Abstract

Introduction
Since the 1990’s, the surgical treatment for colorectal cancers has seen substantial developments over the years, particularly following the introduction of minimally invasive surgical concept by the use of laparoscopic surgery. This minimally invasive surgical modality has seen further progress since the advent of robotic surgery. Although robotic right hemicolecotomy, performed in the standard fashion, has been performed safely for right colon cancers, there seems to be debate about the added advantages of robotic approach over a laparoscopic approach. However, a robotic right hemicolecotomy with D3 lymphadenectomy and complete mesocolic excision potentially might offer additional benefits.

Methodology
We report here a detailed operative technique and feasibility for performing a robotic right hemicolecotomy with D3 lymphadenectomy and complete mesocolic excision and using intracorporal anastomosis.

Conclusion
We believe that robotic right hemicolecotomy with D3 lymphadenectomy, with complete mesocolic excision, is a realistic and feasible operation for right colon cancers.

Introduction
The right colon cancers have been traditionally treated with a standard open right hemicolecotomy, and over the last two decades this has been similarly performed by a laparoscopic approach. Since the advent of robotic colorectal surgery, first reported by Weber et al. in 2002 for robot-assisted colecotomy, there has been an increasing trend for the use of robotic surgery in colorectal cancer resections over the years.

Robotic right hemicolecotomy has been shown to be feasible and safe, especially from an oncological point of view in several studies. The main areas of debate surround around longer operative times and higher cost involved in robotic surgery compared to laparoscopic surgery. These comparative studies and evidence have been primarily, when a standard right hemicolecotomy was undertaken. The concept of D3 lymphadenectomy as introduced by the Japanese surgeons and a similar concept of complete mesocolic excision (CME) proposed by European surgeons provides increased radicality in oncological resections and hence, potentially offer the possibility of better oncological advantage.

Although there have been well-documented reports of D3 lymphadenectomy or CME performed laparoscopically, there are only very limited reports in the published literature regarding this undertaken, robotically. We describe technical aspects of our operative approach to perform a totally robotic right hemicolecotomy with D3 lymphadenectomy and CME and intracorporal anastomosis.

Methodology

Operative techniques for robotic right hemicolecotomy with D3 lymphadenectomy and CME and intracorporal anastomosis

We used the da Vinci Surgical System (Intuitive Surgical Inc., Sunnyvale, CA).

Patient position, port placement, cart placement and Robert docking
Once general anaesthesia is induced, patient is supine positioned over bean bags that are used as anti-sliding restrainers. Prior to start of operation, we use standard pre-operative measures of antibiotics prophylaxis, urethral catheterisation, anti-embolic compression stockings and pneumatic calf-muscle pumps. It is also advisable to place some cotton roll/gel padding between left shoulder of the patient and bean bag to prevent undue pressure on patient shoulder from the vacuum-hardened bean bags.

We use five ports as standard for our robotic right hemicolecotomy procedures as follows (Figure 1):

- Camera port in the left spinousmibulical line (SUL, line joining left anterior superior iliac spine and umbilicus) at a position 2~3 cm medial to left mid-davicular line (MCL). We use a balloon of 12 mm camera port in obese patients. The robotic arm 1 port is placed on the left MCL, around 8 cm below the costal margin. The robotic arm 2 is placed in the midline, in the suprapubic area, with distance to symphysis pubis of 3 cm. The robotic arm 3 is placed on right SUL and 2 cm lateral to right MCL. Apart from the 12 mm camera robotic port, rest of the robotic arm ports are 8 mm in size. A final 5th port is inserted for the assistant, which is a 5 mm port placed in the left iliac fossa, just lateral to left MCL. The assistant port is primarily used for suction and can also be used for gentle bowel retraction.

Once all the ports are inserted, with the optical port inserted first under direct vision using open Hassan’s technique, the patient is placed in a 15~30° Trendelenburg tilt and a 15°
Methodology

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identify and preserve the duodenum, right ureter and gonadal vessels.

The next step of operation is to dissect off the greater omentum, in the avascular plane, from the distal third of transverse colon and works proximally. However, if the tumour is situated at hepatic flexure or proximal transverse colon, we divide the right half of greater omentum so as to include with the final resection specimen. The superior mobilisation of transverse colon is then completed over the hepatic flexure. The lateral dissection is then completed, dissecting off the lateral attachments of the right colon. The terminal ileal mesentry is also dissected free.

The transverse colon is then transected (Figure 6) using ‘Echelon FLEX™ 60 blue cartridge’ stapler (Ethicon Endo-Surgery, Inc.). The terminal ileum is also stapler transected (Figure 7) in a similar fashion. In order, to introduce the stapler, the third robotic arm port, in the suprapubic site, is temporarily undocked and then this site is enlarged to insert a 12 mm port so as to accommodate the stapler. (Also to be noted is that this site eventually becomes the specimen extraction site). The specimen is then placed in a retrieval bag (Figure 8) and the bag is closed around its purse-string.

The terminal ileum and distal transverse colon resected ends are placed adjacent to each other, after ensuring that there is no mesenteric twist, and a stay suture is applied (Figure 9) to aid the approximation of the bowel segments and to use as a traction during stapler insertion. An enterotomy and colostomy are made to aid the insertion of ‘Echelon FLEX™ 60 blue cartridge’ stapler and a side-side; iso-peristaltic, stapled anastomosis is then created intracorporeally (Figure 10). The enterotomy and colostomy stapler insertion site is then closed with continuous stitches using intracorporeal robotic suturing (Figure 11). Prior to anastomosis, checks are made to ensure a tension-free anastomosis with good blood supply. Following anastomosis, staple lines and enterotomy closure sites are inspected to ensure integrity of closure and that the anastomosis is healthy and patent.

The specimen bag is then grasped with a grasper from the assistant port and then the robotic arms are undocked. Haemostasis is ensured prior to undocking, and following undocking, haemostasis is ensured of the port sites. The suprapubic port site is area, which is enlarged

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Methodology

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Figure 7: Stapler transection of terminal ileum.

Figure 8: Resected specimen insertion into retrieval bag.

Figure 9: Placement of stay suture prior to stapler anastomosis.

Figure 10: Stapler anastomosis, ileo-transverse colic, side-side, iso-peristaltic.

Figure 11: Intracorporeal suturing of stapler entry enterotomy site.

Figure 7: Stapler transection of terminal ileum.

Figure 8: Resected specimen insertion into retrieval bag.

Figure 9: Placement of stay suture prior to stapler anastomosis.

Discussion

Robotic colonic surgery has gained some interest in recent times following the first reported robot-assisted colectomy in 2002. Comparisons of robotic colonic surgery to laparoscopic surgery have shown comparable outcomes, and further studies have shown acceptable safety and oncological outcomes for robotic right colonic surgery. However, there are disadvantages for robotic surgery with longer operating times and increased costs.

The concept of CME, with central vascular ligation, where the tumour along with the entire associated mesocolon is dissected along the embryological planes and resected after ligation near the origin of central vascular tree, has been getting some increased prominence following better oncological outcomes. The Japanese surgeons as per their national colorectal society advocate a similar approach in their D3 lymphadenectomy for their advanced colon cancers and with a similarly better outcome. The concept of CME, with central vascular ligation, where the tumour along with the entire associated mesocolon is dissected along the embryological planes and resected after ligation near the origin of central vascular tree, has been getting some increased prominence following better oncological outcomes. The Japanese surgeons as per their national colorectal society advocate a similar approach in their D3 lymphadenectomy for their advanced colon cancers and with a similarly better outcome. The concept of CME, with central vascular ligation, where the tumour along with the entire associated mesocolon is dissected along the embryological planes and resected after ligation near the origin of central vascular tree, has been getting some increased prominence following better oncological outcomes. The Japanese surgeons as per their national colorectal society advocate a similar approach in their D3 lymphadenectomy for their advanced colon cancers and with a similarly better outcome. The concept of CME, with central vascular ligation, where the tumour along with the entire associated mesocolon is dissected along the embryological planes and resected after ligation near the origin of central vascular tree, has been getting some increased prominence following better oncological outcomes. The Japanese surgeons as per their national colorectal society advocate a similar approach in their D3 lymphadenectomy for their advanced colon cancers and with a similarly better outcome.

Conclusion

We believe that robotic right hemicolectomy with D3 lymphadenectomy and complete mesocolic excision is an oncologically sound and feasible operation for right colon cancers. However, considering the lack of available comprehensive comparative data, it is not possible at this time to fully establish the benefits of this procedure. Further studies are required to evaluate the true role of robotic surgery, particularly from an oncological point of view.
the current time to have a true overall picture and conclusively establish any benefits of robotic approach over a laparoscopic or conventional-open operation.

**Abbreviations list**

CME, complete mesocolic excision; MCL, mid-clavicular line; SB, small bowel; SMA, superior mesenteric artery; SMV, superior mesenteric vein; SUL, spinoumbilical line.

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**References**
