One of the reasons why certain trials that compared laparoscopic and open resections had negative results was that they included a higher proportion of low rectal cancers. Very low in the pelvis, it becomes exceedingly difficult for non-articulating instruments to perform intricate dissection, thus increasing conversions to open surgery and inadequate total mesorectal excision (TME) quality. These problems are compounded by neo-adjuvant radiation, narrow male pelvis and obesity. The robotic platform was expected to overcome some of these hurdles by wristed movements, 3D vision, seven degrees of freedom, tremor filtration and a stable optical system under the control of the operator.

The validity of this hypothesis was supported by multiple non-randomized studies. The national cancer database (NCDB) comparison demonstrated a 9.5% conversion rate for robotic resection versus 16.4% for laparoscopic surgery [1]. In terms of pathological quality, a small randomized controlled trial (RCT) of 163 patients exhibited high quality TME specimen for both robotic and laparoscopic proctectomy [2]. Few cohort studies have reported on the oncological equivalence of robotic and laparoscopic resections. A 3 year LR of 2.7% for robotic and 6.3% for laparoscopic surgery (p – 0.42) with similar DFS and OS was reported from two single institution studies [3,4].

All trial comparing laparoscopic to open resection in the long term showed similar oncological outcomes with short term benefits of reduced pain, early ambulation and discharge. However, apart from the COREAN study, they were associated with high conversion rates to open surgery ranging from 10 to 34 percent [5]. The laparoscopic arm in the COLOR 2 trial demonstrated improved outcomes for low rectal cancer compared with open surgery, while mid rectal cancers had suboptimal outcomes in the laparoscopic arm [6]. Studies that compared laparoscopic and robotic rectal resections showed similar short term outcomes but lower conversion rates in the robotic group which laid the basis for the ROLARR trial, the only randomized study comparing robotic and laparoscopic rectal resections [7].

In the ROLARR trial, the primary end point was the conversion rate while pathological and quality of life parameters were secondary outcomes. Conversion rate was lower in the robotic surgery arm without statistical significance, 8.1% vs. 12.2% (OR – 0.61 p - 0.12). Similar CRM positivity and TME quality was noted in both groups. The trial began accruing when data only from MRC CLASSIC trial was available, where conversion rates for laparoscopic surgery was 34%. Trial design was based on these assumptions, which is why the difference in conversion rates did not reach statistical significance in this superiority study design. In a subset analysis, a higher BMI led to more conversions in the laparoscopic group. (OR – 16.1; p - <0.001) This suggests the potential role for robotic resection, where visibility and manipulation in the low pelvis becomes an obstacle. Similarly, male patients had higher conversions with laparoscopic resections (OR – 6.9; p- 0.04). Lastly, when the intended procedure was sphincter preservation for low cancers rather than an abdominoperineal excision, laparoscopic cohorts experienced higher conversion (OR – 7.2; p – 0.007). All of these 3 variables reflect in essence the same point that intricate dissection with precision is possible with greater comfort using the robotic platform. With regards to the secondary end points in the trial, there were no differences in pathologic margin positivity, TME quality, complications or quality of life at 6 months. Some retrospective studies also described early recovery of urinary and sexual outcomes which could not be confirmed by this trial. Another trial with similar study design has completed accrual whose

results are awaited. The COLRAR trial compares robotic and laparoscopic resections with primary outcomes being completeness of TME and pathologic CRM positivity.

Another caveat of the ROLARR trial was that even though majority of the surgeons were experienced laparoscopists, they were still in the learning phase of robotic surgery. With increasing experience, the pathological results as well as conversion rates have reduced further [8]. A secondary analysis of the same trial, to adjust for the learning curve of a relatively new procedure for the surgeons involved (robotic TME) against an established standard for which the participating operators are skilled, was performed. The learning effects model suggested that increasing robotic experience and not laparoscopic experience reduced the odds of conversion to open surgery [9]. This however, does not imply that the laparoscopic learning curve is shorter or that the number of operations performed laparoscopically has no bearing on conversions. Rather, this may be due to the recruitment of already skilled laparoscopic surgeons in the trial.

More complex operations are possible with the robotic platform with ease. These include lateral pelvic node dissection [10-12], extended TME [13] and beyond TME or exenterative procedures [14,15]. Lastly, intra-corporeal suturing, which remains the greatest hurdle in laparoscopic surgery, is effortlessly performed robotically allowing creation of urinary conduits and urinary anastomosis after pelvic exenteration [16,17].

However, the availability of the robot and the cost implications limit the universal applicability of the robot to all rectal resections in India [18]. Thus, its use has to be triaged to complex, multi-visceral and extended resections and possibly for male patients with high BMI and narrow pelvis with low tumours planned for sphincter preservation. Overall, expenditure will undoubtedly reduce with time and the indications for the use of robot are likely to expand with emergence of competing robotic developments and wider availability of the machine.

Level I evidence currently has given conflicting reports regarding superiority of robotic over laparoscopic resections while Level IV evidence suggests pathological and oncological equivalence of robotic and laparoscopic resections. Selective use of the robotic platform by experienced surgeons for low rectal cancers, high BMI and male patients, especially for sphincter preservation can be considered after deliberation on patient preferences and costs. Robotics provide a unique avenue to perform more complex resections including lateral pelvic node dissection, extended and beyond TME operations.

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