

Outcomes of the Istanbul Symposium on minimally invasive and robotic cardiac surgery

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The Turkish Society of Cardiovascular Surgery (TSCVS) has been actively engaged in organizing congresses, school programs for education, local meetings, and symposiums on thoracic and cardiovascular surgery since 1988. The main goals of all these programs are to educate new generations, to share growing experience with other colleagues, and to promote the best health care to patients with cardiovascular disease. The most final of these symposiums took place at Istanbul Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Hospital (IMAEH) on the date of December 20th, 2019. The symposium hosted different aspects and experiences on minimally invasive and robotic cardiac surgery in adult patients. The conference lasted for one day and cardiac surgeons, adult cardiologists, nurses, technicians, and perfusionists attended the meeting. Twelve researchers from different hospitals shared their experiences. After scientific sessions, a wet-lab panel was held on robotic cardiac surgery, including simulation training on the daVinci robotic surgical system.

At the Istanbul Symposium on minimally invasive and robotic cardiac surgery by our society, the welcoming messages were given by the chief physicians of the Department of Cardiovascular Surgery of IMAEH, Assoc. Prof. Burak Onan, MD and Prof. Vedat Erentuğ, MD. Then, Baris Timur, MD and Aylin Demirel, MD presented their brief speeches to introduce the experimental animal laboratory of the hospital for animal research and life support systems. The chief of the hospital, Mehmet Erturk, MD presented a welcome speech. Prof. Mehmet Ali Özatik, MD, who is the president of the TSCVS, welcomed the attendees and presented a short lecture on the current status of minimally invasive and robotic cardiac surgery in Turkey (Figures 1 and 2).

FIRST PANEL: INTRODUCTION TO MINIMALLY INVASIVE AND ROBOTIC CARDIAC SURGERY

The first speech of this section was about the history and future of minimally invasive cardiac surgery in the world, as well as in Turkey. Prof. Belhhan Akpınar, MD offered an inspiring lecture to the attendees. Of note, he is a mentor and one of the pioneers of minimally invasive cardiac surgery in Turkey. Akpınar and his colleagues performed the initial series of port-access cardiac surgery in 2001, as well as the first robotic cardiac procedures in Turkey in 2004.^[1,2] He adapted the surgical technique of endoscopic mitral valve surgery (by Vanerman, MD in OLV clinic from Belgium) to his colleagues and fellows. Since then, more than 762 port-access endoscopic cardiac operations were performed in his carrier. In his lecture, he summarized that the number of minimally invasive and robotic cardiac procedures in Turkey has dramatically increased after 2010 and more than 1,300 robotic surgeries have been performed in our country since 2013. Next generation robotic devices and innovations in this field were also mentioned by Akpınar, MD.

In addition, Assoc. Prof. Burak Onan, MD shared preferences of the IMAEH for patient selection in minimally invasive cardiac surgery and his experiences during the learning curve period. Onan and his

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Figure 1. The speech of Prof. Mehmet Ali Özatik, MD at Istanbul symposium.



Figure 2. The Istanbul Symposium on minimally invasive and robotic cardiac surgery.

colleagues performed more than 550 robotic cardiac procedures since 2013. He is also experienced with minimally invasive port-access procedures in terms of patient selection and technical details. He gave a lecture about the details of preoperative patient selection in the learning curve period. He also noted that the procedures were totally different, and the surgeons should have a considerable experience in conventional techniques and peripheral cannulation before starting mini-operations. The initial cases should be selected among patients without associated comorbidities and patients should have simple and isolated pathologies, such as atrial septal defect or mitral valve replacement. Also, the selection of an ideal patient initially and the mentorship during the learning curve period are both beneficial for the volunteers.

Unal Aydın, MD from the IMAEH shared his and his colleagues' experiences and protocol on step-by-step surgical set-up for robotic cardiac surgery. Since 2013, more than 100 patients in each year underwent robotic procedures and almost 70% of these cases were mitral valve repair or replacement and atrial septal defect closure procedures. The mortality rate for robotic procedures was less than 2% based on their experiences for mitral procedures. The steps included endotracheal intubation, jugular vein and femoral vessel cannulation, port placement, docking, cardioplegia method, and cardiopulmonary bypass period. Aydın, MD noted that each of these surgical steps should be performed uneventfully for a successful and excellent outcome of a robotic operation. For instance, jugular vein or femoral cannulations should be done without any complication under transesophageal echocardiography guidance, or port placement should be done in the proper position to prevent technical failure and unexpected events. The choice of cannulas and surgical instruments should be also selected appropriately.

Then, Ersin Kadirogullari, MD from the IMAEH gave a lecture on perfusion and myocardial protection strategies. Accordingly, all members of the operation should be aware of the work and minimally invasive procedures need a teamwork, as all we know. Peripheral cannulation is a major step for establishing of cardiopulmonary bypass in minimally invasive cardiac surgery.^[3] Technically, Kadirogullari, MD suggested that jugular vein cannulations could be done using 17F cannulas. Femoral venous cannulas should be the appropriate size rather than selecting a larger size and venous drainage during cardiopulmonary bypass can be augmented with suction devices with experienced

perfusionists. Specifically, positive pressures may cause air embolization, whereas higher negative suction (more than -50 mmHg) may cause collapse of the venous system. Therefore, he recommended the use of alert systems and adjustment of safe range between +5 and -100 mmHg. He also mentioned the risk of aortic dissection during peripheral cardiopulmonary bypass and warned young surgeons about the necessity of safe arterial cannulation techniques. Cardioplegia techniques and solutions (isothermic blood, Custodiol® or del Nido®) were also reviewed. The safe periods are up to 90 to 120 min with Custodiol® solution and up to 60 min with del Nido® solution. He summarized that there was no ideal technique in minimally invasive procedures and the most important aspect was the communication and teamwork.

SECOND PANEL: ROBOTIC CARDIAC SURGERY

Opening of the second panel began with presentation of Kerem Oral, MD from Florence Nightingale Hospital on robot-assisted minimally invasive direct coronary artery bypass (MIDCAB). His clinic has a great experience in robotically enhanced procedures.^[4] The author presented the technical details of harvesting the left internal thoracic artery with the use of the daVinci system. Then, operative details were presented with a live-in-box demonstration. He also presented his and his colleagues' clinical experience in robotically enhanced MIDCAB procedures between 2004 and 2018. A total of 286 patients operated and four of them were totally endoscopic bypass grafting cases. In the other cases, 197 patients had a single left internal thoracic artery-to-left anterior descending artery bypass grafting. Eighty-four patients had two-vessel coronary artery bypass grafting (CABG). Conversion was needed in only seven cases. He also recommended robotic MIDCAB as an alternative to a sternotomy incision in patients with comorbidities in terms of a hybrid approach. He summarized that the patency rate of robotic MIDCAB procedures could be comparable to conventional operations.

Subsequently, Assoc. Prof. Burak Onan, MD from the IMAEH made a speech on robotic mitral valve surgery. He stated that the difference of robotic surgery from the other minimally invasive techniques was the easy instrumentation and enhanced three-dimensional (3D) surgical view of robotic systems. Also, he mentioned the other advantages such as

a better exposure of the subvalvular apparatus and improved cosmetic results. Based on a brief literature review, he stated that operative risks and mortality of robotic procedures were similar to conventional procedures.^[5-7] Onan, MD also noted that this approach could be a safe alternative to sternotomy and the other techniques. In addition, he stated that mitral repair procedures could be done successfully, and the use of robotic technique was feasible and safe. The conversion rate can be decreased with a proper port placement after a learning curve period of 30 or 50 procedures. Robotic surgery is still evolving, and new devices are available soon which makes this approach an alternative for all patients. However, the cost issue is still a major problem in developing countries.

Prof. Sahin Senay, MD from Acıbadem University, Faculty of Medicine continued with robotic approach to intracardiac pathologies and shared his experiences on robotic cardiac surgery. Prof. Senay, MD is the current Editor-in-chief of The Turkish Journal of Thoracic and Cardiovascular Surgery and is a member of the Editorial Board of the International Society of Minimally Invasive Cardiac Surgery. He has a great experience in technical and philosophical details of minimally invasive and robotic cardiac surgery. In the symposium, he gave a great lecture on the feasibility of robotic procedures including valve repair, complex repair, intracardiac tumor resection, and atrial septal defect closures. He also summarized technical pitfalls and surgical approaches to intracardiac robotic procedures with the aid of video presentations.

Prof. Cengiz Bolcal, MD from Ankara Gulhane Training and Research Hospital continued with his experiences in reoperations using robotic surgery system. Technically, robotic reoperations can be done in patients with mitral and tricuspid valve pathologies. These patients may have a previous mitral valve replacement, repair, or CABG through a sternotomy incision. He noted that the procedures could be done on a beating heart, as well as on cardiac arrest under cardiopulmonary bypass, if aortic clamping was possible. The author stated that beating-heart technique could be preferred to ventricular fibrillation in terms of better myocardial protection. Prof. Bolcal, MD also provided technical details of deairing maneuvers to prevent systemic air embolization: both the left atrium and ventricle should be drained continuously during the procedure and left ventricular suction should be kept in its place through the mitral prosthesis,

until the closure of the left atriotomy. Carbon dioxide insufflation is also mandatory. With this technique, Prof. Bolcal, MD and his colleagues uneventfully operated 14 patients so far, including 12 mitral valve procedures and two right atrial tumor excisions.

THIRD PANEL: AORTIC, MITRAL, AND MIDCAB

Opening of the third panel was assured by Prof. Ertan Sagbas, MD from Florence Nightingale Hospital who presented robot-assisted MIDCAB endoscopic port-access mitral valve surgery. Prof. Sagbas, MD is also one of the pioneers of minimally invasive endoscopic heart surgery in Turkey. He noted that the first truly video endoscopic port-access operation in their clinic was an atrial septal defect closure operation in 2002. The first robotic operation of Turkey was performed in 2004 by the team of Prof. Akpınar, MD. Port-access technique can be used for mitral and tricuspid valve pathologies, atrial septal defect closure, and myxoma excision. Prof. Sagbas, MD also commented on mitral valve repair techniques including resection and respect philosophy. During the last decade, he preferred neo-chordae implantation for mitral repair and, with this technique, his success rate was above 95%. He summarized that endoscopic port-access approach to mitral valve procedures was safe, effective, and durable with favorable long-term results.

The second lecture was delivered by Assoc. Prof. Mehmet Kaya, MD from the IMAEH on minimally invasive aortic surgery through a mini-sternotomy incision. He presented technical pitfalls and tips for a successful minimally invasive aortic surgery. He stated that aneurysms of the aortic root, ascending aorta, and even aortic arch could be treated through a mini-sternotomy incision. He summarized the details of these procedures with a video lecture on this topic.

Prof. Serkan Durdu, MD continued with minimally invasive aortic valve replacement through lateral mini-thoracotomy. He noted that this approach could be an alternative to sternotomy or J-sternotomy incision in patients with preoperative comorbidities.^[8,9] However, he noted that surgical experience was mandatory. Operative steps and details were presented, and his and his colleagues' experiences were shared with the attendees. He also presented their clinical experiences previously.^[6]

From January 2013 through March 2018, 13 patients with severe aortic stenosis involving bicuspid aortic valve underwent aortic valve replacement in their center. The mean age was 72.8 ± 2.3 years ranging from 70 to 77, and 53.8% of the patients were males. Minimally invasive approach through right anterior thoracotomy from the third intercostal space was performed in all patients. There was no in-hospital mortality. He suggested that this approach was a technically feasible and safe procedure in patients with severe aortic stenosis.

Prof. Cem Alhan, MD from Acibadem Hospital gave a great lecture on the surgical approach to transcatheter aortic valve implantation (TAVI). He encouraged the attendees to play an active role in minimally invasive procedures, TAVI, and surgical options. The long-term durability of TAVI valves and surgical options were discussed. He noted that the results of the PARTNER 2 trial found that the five-year outcomes for patients with an intermediate operative risk having surgical aortic valve replacement were significantly better than for those having the TAVI procedure. This means that for every 100 patients dying within five years of having the TAVI procedure, 75 would have died having had surgery. Also, the cost analysis of TAVI was discussed. He summarized that TAVI could be an alternative for patients who had a high operative risk, as well as for patients with advanced age (above 80 years) and poor two-year survival. He also noted that no literature evidence was present currently on the application of TAVI to young adults. Thus, he recommended that surgical aortic valve replacement was a reasonable choice for all patients in terms of favorable long-term results and reasonable cost.

Prof. Baris Caynak, MD presented a novel technique for minimal invasive cardiac surgery, entitled "multi-vessel MIDCAB through mini-thoracotomy". This experience for coronary revascularization has not been presented in Turkey previously. In this technique, multi-vessel CABG procedures can be performed without making a sternotomy incision. Instead, a 6 to 8-cm mini-thoracotomy incision is used. Prof. Caynak, MD suggested that this approach could be preferred for all patients who were candidates for CABG. He also noted that age, sex, body mass index, ejection fraction, and number of anastomoses or localization of the lesions were not a contraindication for this procedure. Technical details were presented in a live-in-a-box presentation. The left internal thoracic

artery was harvested with the help of a specially designed chest retractor through mini-thoracotomy incision and coronary anastomoses were done under cardiopulmonary bypass and cardiac arrest. Using this technique, Prof. Caynak, MD performed 62 procedures and 189 coronary anastomoses without any mortality. In 49 patients, the right coronary system was vascularized together with the left coronary system. The mean lengths of intensive care unit and hospital stay were 1.2 ± 0.6 days and 5.3 ± 2.7 days, respectively. He concluded that this technique could be feasible, safe, and alternative to a sternotomy incision for all patients.

LAB PANEL

In this section, Assoc. Prof. Burak Onan, MD, Ünal Aydın, MD and Ersin Kadirogullari, MD shared their experiences on robotic surgery. In the operating room, small groups studied on robotic simulation and manipulations, and had some technical and theoretical information about the daVinci system and robotic operations. Meanwhile, the attendees had the opportunity of using 3D endoscopic visualization and instrumentation.

COMMENTS

Prof. Aydin Aytac, MD, who was a great mentor and pioneer of cardiac surgery in Turkey, presented a valuable manuscript that shed light on the history of cardiovascular surgery in our country.^[7] According to this report, the initial cardiac procedures were closed by mitral commissurotomy which were performed in 1953 and 1954 by Prof. Nihat Dorken, MD and Prof. Fahri Arel, MD in Istanbul and Dr. Orhan Mumin and Prof. Hilmi Akın, MD in Ankara. The first cardiac surgery series were performed by Prof. Aytac, MD in Hacettepe University, Pediatric Hospital after June 1962. Since then, many pediatric and adult cardiac procedures were successfully done using cardiopulmonary bypass. As the new surgical devices and innovations of minimally invasive techniques have been developed, the number of patients undergoing minimally invasive procedures has increased tremendously since late 1990s. Mitral valve procedures, closure of intracardiac defects, excision of tumors, and ablation surgeries have been done frequently. In particular, during the last two decades, cardiac surgical procedures which utilize mini-incisions and robotic systems have been

performed widely in Turkey. The community and young cardiac surgeons are highly interested in innovations and novel techniques. Complex cardiac procedures and even reoperations can be performed through exceedingly small access points in robotic surgery.

In conclusion, minimally invasive and robotic cardiac surgery can be successfully performed for aortic, mitral, coronary artery, and intracardiac pathologies. The choice of surgical incision and technique depends on the access routes or surgical incisions according to surgeon's preferences and experience. Nevertheless, a learning curve period and mentorship would be beneficial for young generations and those who are willing to start a new program of minimally invasive cardiac surgery. In the future, no one knows exactly how cardiac surgery would progress with innovations; however, the surgeons are expected to be adapted to changes in this field.

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REFERENCES

1. Sağbaş E, Sanisoğlu İ, Güden M, Çaynak B, Akpınar B. Robotically enhanced totally endoscopic coronary artery bypass surgery in three cases. *Turk Gogus Kalp Dama* 2008;16:254-6.
2. Akpınar B, Guden M, Sagbas E, Sanisoglu I, Ozbek U, Caynak B, et al. Combined radiofrequency modified maze and mitral valve procedure through a port access approach: early and mid-term results. *Eur J Cardiothorac Surg* 2003;24:223-30.
3. Onan B, Aydın Ü, Kadiroğulları E, Erkanlı K. An alternative peripheral arterial cannulation in minimally invasive and robotic cardiac surgery. *Cardiovasc Surg Int* 2016;3:91-3.
4. Ezelsoy M, Caynak B, Bayram M, Oral K, Bayramoglu Z, Sagbas E, et al. The Comparison between Minimally Invasive Coronary Bypass Grafting Surgery and Conventional Bypass Grafting Surgery in Proximal LAD Lesion. *Heart Surg Forum* 2015;18:E042-6.
5. Onan B, Aydın U, Kadirogullari E, Onan IS, Sen O, Kahraman Z. Robotic repair of partial anomalous pulmonary venous connection: the initial experience and technical details. *J Robot Surg* 2020;14:101-7.
6. Onan B, Aydın U, Kadirogullari E, Onan IS, Sen O. Totally Endoscopic Robotic-Assisted Cardiac Surgery in Children. *Artif Organs* 2019;43:342-9.
7. Onan B. Coronary revascularization in robotic cardiac surgery. *Cardiovasc Surg Int* 2018;5:48-59.
8. Durdu MS, Gumus F, Ozcinar E, Cakici M, Bermede O, Dincer I, et al. Sutureless Valve Replacement Through a Right Anterior Mini-thoracotomy in Elderly Patients With Stenotic Bicuspid Aortic Valve. *Semin Thorac Cardiovasc Surg* 2019;31:458-64.
9. İnan MB, Özçınar E, Dikmen Yaman N, Durdu S, Aral A, Şırlak M, et al. Right anterior thoracotomy approach for isolated aortic valve replacement with sutured aortic valve prosthesis. *Cardiovasc Surg Int* 2016;3:31-3.
10. Aytaç A. Dünyada ve Türkiye'de kalp cerrahisi. *Turk Gogus Kalp Dama* 1991;1:8-12.