



A STUDY TO CALCULATE PACKAGE COST OF TRANSCATHETER AORTIC VALVE REPLACEMENT (TAVR) IN A CARDIOTHORACIC HOSPITAL

Hospital Administration

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ABSTRACT

Transcatheter Aortic Valve Replacement (TAVR) is a minimally invasive procedure used to treat severe aortic stenosis without open-heart surgery. Despite its effectiveness, TAVR is cost-intensive and performed in only a few hospitals in India. This study aimed to determine the package charges for TAVR to facilitate its adoption in more centers. Conducted in a super specialty hospital's Cardiac Catheterisation Laboratory, the study analyzed consecutive TAVR procedures over 12 months. Data were collected through observations, document reviews, and informal interviews, focusing on both direct (e.g., equipment, medicines, human resources) and indirect costs (e.g., infrastructure, utilities). The total cost per TAVR procedure was found to be Rs 23,17,401.14, with direct costs at Rs 23,01,492.49 and indirect costs at Rs 15,908.65. Compared to the cost in developed countries, which averages around Rs 32,46,625.52, the procedure in India is less expensive. The study's findings can assist other hospitals in introducing TAVR by selecting cost-effective devices, thereby optimizing resource allocation.

KEYWORDS

Cost, Direct Cost, Indirect Cost, TAVR

INTRODUCTION

Globally Cardiovascular diseases are the number one cause of death.[1] The WHO suggest that three times as many deaths from cardiovascular causes are occurring in low-middle income countries, affecting males and females equally. By 2030, almost 23.6 million people will die from CVDs, mainly from heart disease and stroke.[2] India contributes disproportionately to the global burden of diseases due to cardiovascular diseases (CVDs) which accounted alone for 28.1% of all deaths.[1]

Percutaneous catheter-based procedures have increased dramatically for a wide spectrum of structural heart diseases. A large number of patients who in the past would have required open heart surgery can now be treated with alternative, non-surgical therapies performed in cardiac catheterization laboratories.[3] Recently, Transcatheter Aortic Valve Replacement (TAVR) has emerged as a lifeline for patients with aortic stenosis who cannot be operated on, thereby improving symptoms and statistically significant mortality benefit.[4]

In 2012, the FDA approved TAVR in patients at high surgical risk. In 2016 the FDA approved TAVR valves for use in patients with severe AS at intermediate risk. Following the results of the PARTNER-3 trial published in 2019, the FDA further expanded the indication for TAVR valves to include low-risk patients.[4] Prior studies examining the costs of AS care have yielded varying results. In general, TAVR has been associated with increased up-front costs but decreased post-procedural resource utilization in comparison to Surgical Aortic Valve Replacement (SAVR).[5]

Cost information is part of the basic information needed by managers and policymakers for making decisions about improving a hospital's performance. It also helps to identify various areas for cost containment and helps to set prices for the procedures.

There are two types of healthcare costs, direct cost which includes hospitalization costs, physician's costs, and medication costs and indirect costs which are the cost of electricity, cost of laundry, dietary costs, and equipment maintenance costs.

TAVR is a new and highly cost-intensive procedure being done in very limited hospitals in our country, there was a felt need for costing per package charges of this procedure so that it can be planned to introduce this procedure in other centres also. Currently, TAVR is not included in the package charges for various procedures under ECHS, CGHS and various other insurance packages, so ascertaining the package charges

of TAVR may help in the introduction of these procedures in the various insurance packages and will help insurance companies to set their premium accordingly.

The Objectives of the Study are:

1. To study the processes involved and resources required for TAVR procedure.
2. To apportion the cost of various elements identified during the process.
3. To ascertain the cost of unit package charges for TAVR.

Methodology

The study was carried out in the Cardiac Catheterisation Laboratory of 600 bedded cardiothoracic super speciality hospital. It is a costing exercise based on the processes involved and the resources required for the TAVR procedure. It is a descriptive, observational study. It entails classifying costs, identifying cost centres and tracing all costs related to each procedure.

Inclusion Criteria

Observational study of consecutive samples of TAVR over 12 months, i.e. 01 Jan to 31 December 2021 were considered for the study.

Exclusion Criteria

Cost of security service; Two or more concomitant procedures i.e. if two procedures are simultaneously done on the same patient were not included in the study and post-procedure complications were also excluded from the study.

The data was collected by direct observations, the study of documents and informal interview with staff. The study was done in the following four phases:

Phase 1: All processes involved in the TAVR were analysed to identify the cost centres applicable to the procedure.

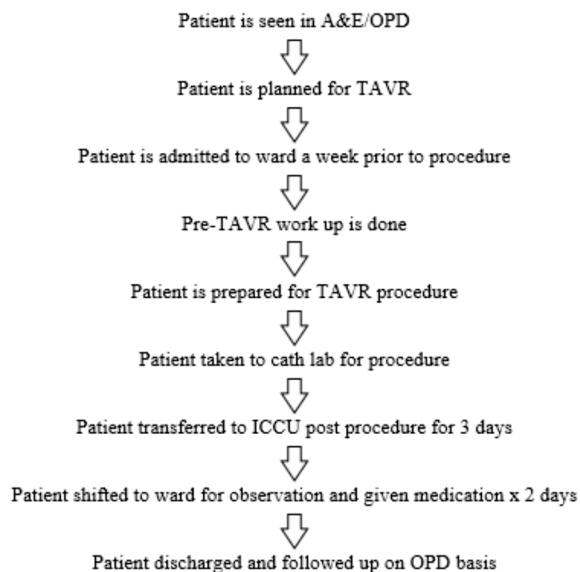
Phase 2: Data was collected for each cost centre & collated and analysed.

Phase 3: The costs elicited for direct and indirect elements were apportioned for the calculation of the total cost per Transcatheter Aortic Valve Replacement procedure.

OBSERVATIONS AND RESULTS

The invasive procedure workload of the cardiac catheterization laboratory was studied. There were a total of 1216 invasive procedures performed during the study period. A total of 07 TAVR procedures were performed.

Before planning TAVR procedure, the patient is assessed by cardiologist. After initial workup and depending upon the patient's condition, the patient is planned for TAVR.



The main cost centres identified per procedure of TAVR are depicted in the table 1 below:

Table 1: Cost Centres Identified for TAVR Procedure

Direct Costs	Indirect Costs
Cost of equipment	Cost of Infrastructure
Cost of Medicine/consumables used	Cost of Infrastructure Maintenance
Cost of Investigations	Cost of Equipment maintenance
Human Resource (HR) Cost	Cost of Electricity
Cost of Diet	Cost of Air conditioning
	Cost of Water consumption
	Cost of Stationary
	Cost of CSSD
	Cost of Laundry

To identify various resources consumed, various cost centres involved in the processes were determined e.g., equipment, medicines/consumables, investigations, human resources, diet, buildings, human resource, building, building maintenance, equipment maintenance, electricity, air conditioning, water consumption, stationary, CSSD, and laundry etc.

After that, apportioning of various cost elements identified during the process was undertaken. The same is depicted in table 2 for the apportioning of direct costs and table 3 for the apportioning of indirect costs. Direct Costs: It is summarised in table 2 below:

Table 2: Direct Costs

S No	Nomenclature	Total Cost (in INR)	% cost
1.	Cost of equipment	10,385.76	00.45
2.	Cost of Device	1,39,666.09	96.10
1.	Cost of consumables	20,72,000.00	
3.	Cost of investigations	23,813.00	01.03
4.	Human Resource (HR) Cost	53,487.08	02.32
5.	Cost of Diet	2,140.56	00.09
Total Direct Cost		Rs 23,01,492.49	100

Indirect costs: Total indirect costs incurred per procedure of TAVR are depicted in the table 3:

Table 3: Indirect Costs

S.No	Nomenclature	Cost (in INR)	% Cost
1.	Cost of Building	160.85	01.01
2.	Cost of Building maintenance	693.11	04.36
3.	Cost of equipment maintenance	3,507.30	22.05
4.	Cost of electricity	8,954.95	56.29
5.	Cost of air conditioning	1,264.68	07.95
6.	Cost of water consumption	436.14	02.74
7.	Cost of stationary	537.60	03.38

8.	Cost of CSSD	46.34	00.29
9.	Cost of Laundry	307.68	01.93
Total Indirect Costs		Rs 15,908.65	100

Total Costs / Transcatheter aortic valve implantation = Total Direct Costs + Indirect Costs i.e. 2301492.49 + 15908.65 which is equal to Rs 23,17,401.14.

Total cost and % of total cost of all the cost centres identified for TAVR procedure is depicted in table 4.

Table 4: Total Cost And % Of Total Cost Of All Cost Centres Identified For TAVR Procedure

S.No	Nomenclature	Cost in Rs	% of Total Cost
1.	Cost of equipment	10,385.76	00.45
2.	Cost of Device	22,11,666.09	95.44
3.	Cost of investigations	23,813.00	01.03
4.	Human Resource (HR) Cost	53,487.08	02.31
5.	Cost of Diet	2,140.56	00.09
6.	Cost of Building	160.85	00.01
7.	Cost of Building Maintenance	693.11	00.03
8.	Cost of equipment maintenance	3,507.30	00.15
9.	Cost of electricity	8,954.95	00.39
10.	Cost of air conditioning	1,264.68	00.05
11.	Cost of water consumption	436.14	00.02
12.	Cost of stationary	537.60	00.02
13.	Cost of CSSD	46.34	00.002
14.	Cost of Laundry	307.68	00.01
Total Cost		Rs 23,17,401.14	

Hence, total package charges for TAVR procedure in the study hospital was calculated as Rs 23,17,401.14.

DISCUSSION

The cost of TAVR is not yet standardised in India, & there is gross variation in cost of procedure in different centres. The estimated procedure cost for TAVR is approximately 35,000 U.S. dollars i.e., INR 28,70,000.00⁶.

According to a study done by Derrick Y. Tam et al on Canadian healthcare setup, the cost of TAVR is \$39,753 which is approximately INR 32,46,625.52⁷.

According to a study done by Takeshi Onohar et al in a Japanese hospital, it was found that the cost of TAVR is Japanese Yen 61,62,223 which is equivalent to INR 36,17,383.36⁸. Due to differences in health care systems in these countries from India, there might be a variation in the costs of TAVR in our set-up and international studies.

Although the cost of TAVR in the U.S. is almost twice that in India, it still remains a gigantic task for the Indian government to support the TAVR program in the public health sector.

In our study, the total package cost of TAVR is calculated to be Rs 23,17,401.14 out of which Rs 20,72,000 is the cost of valve which is 89.41% of the total procedure cost. In the hospital under study, Self-Expanding Recapture and Supra Annular Transcatheter Aortic Porcine Pericardial Valve with External Pericardial skirt with compatible catheter and loading system are being used which is very cost intensive.

Recently, a make in India transcatheter heart valve (THV) has been introduced in the market. It is a CE-marked, newer-generation balloon-expandable TAVR system. Make in India TAVR valve is a balloon-expandable transcatheter aortic valve system which costs Rs 12,84,640.00 which is half the cost of imported value Pro. Hence, it is recommended that hospital administrators and cardiologists choose a cost-effective valve carefully considering the device's risks and benefits. Also, various devices to be procured should be planned before the next financial year as this will help to plan the budget effectively for various procedures.

This study's findings can also help other hospitals in introducing these procedures in their set-up by allotting the budget for these procedures.

CONCLUSION

To conclude, devices consume 80-90% of the procedure cost. Hence, the appropriate device should be selected by the top management by involving the cardiologists involved in the procedure so that cost

implications of the devices at the later stages do not affect the budget allocated for other procedures or departments of the hospital and at the same time patient safety is not compromised which can be prevented by involving the user representatives.

Limitations

The limitations of the study are as follows:

1. Cost of OPD consultation was not considered while calculating the package charges.
2. Being government land, the cost of land was not considered under study.
3. The study cannot be generalised as the findings are from a service setup.

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