

Consensus document on the figure of the TAVI nurse in the haemodynamic working group of the Spanish Association of Nursing in Cardiology

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Summary

The TAVI Nurse is an advanced nursing practice figure that manages the process of patients undergoing transcatheter aortic valve implantation, from diagnosis to subsequent home care after the intervention. This figure is in charge of triage and coordination, clinical, functional, and psychosocial assessment, education of the patient and their family, and leadership of the TAVI program.

At the national level, there are no standardised competencies for the TAVI Nurse, therefore, it is necessary to elaborate a consensus document that defines their functions and competencies.

Via the creation of a group of TAVI procedure nursing experts, a methodology was designed for drafting this document by comparing scientific evidence and experiences in our setting, in order to reach a consensus on functions and competencies at the national level.

After drawing up this consensus document, the challenge in the coming years is to implement this figure in a large part of our country's centres, with a quality register that can be evaluated with indicators that demonstrate the effectiveness of this figure.

Keywords: aortic valve stenosis, transcatheter aortic valve implantation, advanced practice nursing, office nursing, consensus development conference.

INTRODUCTION

Severe aortic stenosis (AS) is the most common valvular disease in developed countries and its increase is related to the prolongation of life expectancy and aging of the population¹⁻². Its estimated prevalence is considerable, being 2.5% and reaching up to 7% in people over 65 years of age³. Patients may remain asymptomatic for many years, but once symptoms begin, AS progresses rapidly and, without intervention, has a mortality of 50% at 3 years⁴⁻⁵.

Around 30-40% of patients with severe AS are not candidates for surgery due to their comorbidities, frailty, and high surgical risk, which has led to Transcatheter Aortic Valve Implantation (TAVI) becoming an effective and safe alternative for selected patients. This manifests a paradigm shift in the treatment of heart valve disease, with a transition to minimally invasive TAVI procedures that allow a reduction in hospital stay, minimise the use of health resources, and optimise the final results without increasing complications or mortality^{3-4,6-13}.

In the 2021¹⁴ National Registry of Interventional Cardiology Activity of the Spanish Society of Cardiology (**figure 1**), we can observe an exponential increase of this type of procedure over the last years. Therefore, it is necessary to develop TAVI programs that place the patient at the centre of the process, guarantee decision-making in a multidisciplinary manner, and ensure the quality of care and safety of these patients at all times.

The TAVI program should include the creation of a specific HEART TEAM (HT) [or TAVI TEAM (TT)] for these procedures, formed by a multidisciplinary team that intervenes directly or indirectly in decision-making, evaluating the suitability, risk, and benefit of this technique. Its composition varies from one centre to another, however, this team is usually made up of clinical cardiologists, cardiac surgeons, interventional cardiologists, anaesthesiologists, geriatricians, cardiac imaging specialists, vascular surgeons, and nurses^{3,8,12} (**figure 2**), and may include, if the case requires it, other specialties or health professionals.

Suitable patient selection is also essential to optimise resources and obtain good results, facilitating quality care and promoting continuity in care, with nursing playing a leading role. Importance should be given to adequate preparation of the pre-TAVI patient, where the nurse can manage the preparation prior to the procedure and guarantee the performance of the necessary tests for an effective and safe diagnosis; and provide efficient health education to adequately prepare the patient and their family³. Similarly, the monitoring of results is crucial, both from the clinical point of view and the patient's experience, and which will help detect areas for improvement. The competencies and experiences of the nurse, maintaining an active role in the process, are ideal to provide leadership within the TAVI program, making it effective and sustainable. Therefore, the role of the nurse is fundamental in the process of this type of procedure, from diagnosis to intervention and in the subsequent follow-up after implantation. The nurse's experience in cardiovascular care reinforces the ability to consolidate and manage the demands of patients undergoing TAVI procedures, as well as facilitate cohesion between different specialists. In addition, they collaborate in patient management and the coordination of every phase of the TAVI program.

The constant worldwide growth of this technique has required the professionalisation of the TAVI program in centres with high volumes via the creation of a program coordinator (TAVI Coordinator). In different centres worldwide, the nurse performs this task, thus demonstrating their ability to manage and coordinate multidisciplinary teams in this context⁸.

THE ROLE OF THE TAVI NURSE

The incorporation of the nurse into the HT has been vital for the development of a specific nursing figure known as the «TAVI nurse»³.

The role of the TAVI nurse arose to improve the quality of care and clinical outcomes in patients undergoing transcatheter aortic valve implantation.

The experience of nurses in Canada, the United States, and the United Kingdom has generated evidence regarding this role. The specific literature details recommendations to improve clinical nursing practices in TAVI patients and develops the role of the «TAVI nurse» and «TAVI coordinator». To this end, programs for heart failure, heart transplantation, cardiac patient, and percutaneous coronary interventionism have been used as a model to develop their own TAVI program with the figure of the TAVI nurse, describing roles, tasks, and competencies, highlighting the leadership role of the nurse³. Hawkey *et al.*,¹² described the competencies and responsibilities of the role, an important step towards the creation of the TAVI nurse in other centres. Thus, the competencies described were:

- Knowledge of cardiovascular pathology, heart valve disease, structural pathology, TAVI, and other treatment options and their complications.
- Experience in cardiovascular care, comorbidities, and geriatric care.
- Ability to anticipate in decisions and patient care.
- Efficient ability to direct the patient and manage their motivations and expectations.

On the other hand, the responsibilities of the TAVI Nurse were described as:

■ TRIAGE AND COORDINATION

- Patient-family-team contact person throughout the process.
- Participation in clinical triage.
- Participation in waiting list management and programming.
- Follow-up coordination.

■ CLINICAL EVALUATION

- Review of the patient's medical history.
- Coordination of the performance of pre-procedure diagnostic tests.
- Functional assessment (frailty, activities of daily living, quality of life).
- Psychosocial evaluation.
- Facilitation of cross-consultations (geriatrics, physiotherapy, social worker).

■ EDUCATION OF THE PATIENT AND THEIR FAMILY

- Verbal and written health education.
- Assessment and management of the patient's expectations.
- Development of an early discharge plan.
- Ability to actively listen and motivational interviewing to empower the patient.

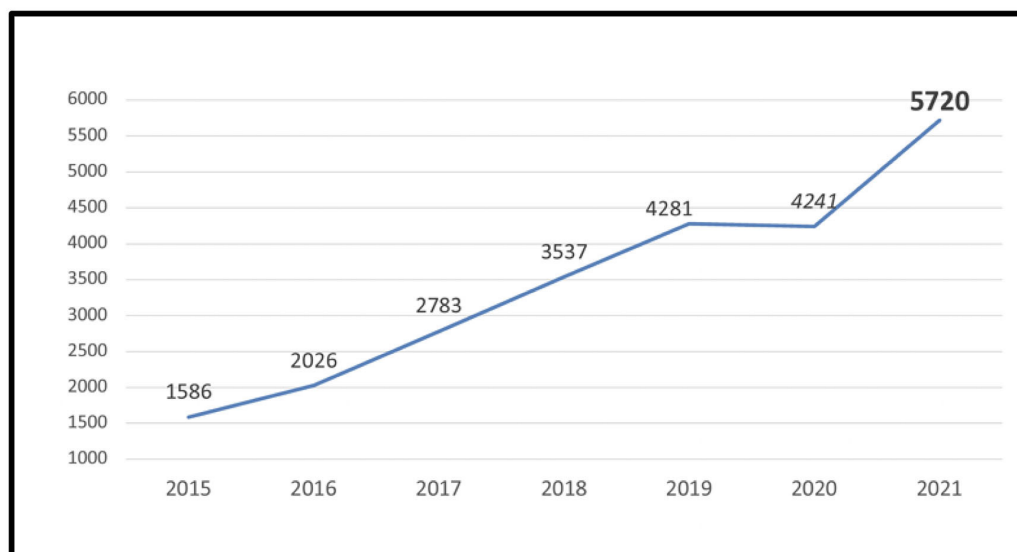


Figure 1. National number of TAVI procedures in 2021 (63 centres).

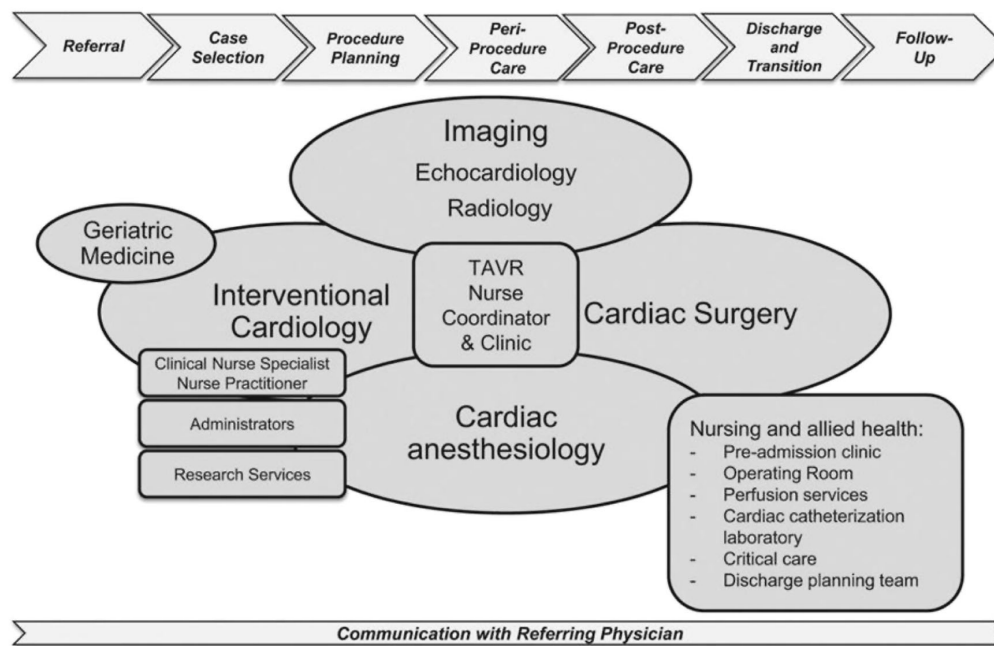


Figure 2. HEART TEAM TAVI. Example of a multidisciplinary team at Vancouver General Hospital (Canada). Source: Lauck SB⁷.

■ TAVI PROGRAM LEADERSHIP

- Ability and willingness to work as a team.
- Participation in the Heart Team or TAVI Team.
- Collaboration in the development of standardised protocols.
- Participation in case selection meetings.
- Participation in TAVI program evaluation supporting the implementation of improvements.
- Participation in outreach initiatives.

NATIONAL LEVEL (SPAIN) «TAVI NURSE» CONSENSUS DOCUMENT

Some registries define the nursing competencies of the TAVI nurse, but there are no standardised competencies

or activities defined at the national level that adapt to the reality of our setting. This is why the need arises to elaborate a consensus document that defines the functions of the TAVI nurse.

Objective:

The objective of this document, prepared by the nursing Haemodynamic working group of the Spanish Association of Nursing in Cardiology (AECC), was to update nursing knowledge in pre- and post-TAVI management and promote the development of multidisciplinary teams that improve the cardiovascular health of patients with aortic valve pathology.

Methodology:

Creation of a TAVI procedure nursing expert group at the

national level. The selection of this group was made based on expert knowledge of the topic, training in healthcare for this type of patient, and experience in the development of a similar figure in national first-level hospitals.

The different topics were distributed into subgroups according to the expert level of each member of the group on each topic and a single work methodology was initiated for all. After the exhaustive bibliographic review of each topic, the nursing competencies and activities described in the literature were analysed, the similarities and differences at the national level were studied and, finally, those that, due to their interest and frequency in our setting, were considered relevant were described. Subsequently, each subgroup presented its analysis to the working group and after the vote and experience of everyone, a consensus was reached for the entire document.

THE TAVI NURSE FIGURE

PRE-PROCEDURE CARE

Once the patient's diagnosis is established and the recommendation for percutaneous treatment, a pre-TAVI nurse visit should be carried out. The objectives of this visit are:

- Ensure patient safety in the diagnostic process
- Educate the patient and their family about the surgical process of TAVI implantation
- Perform a global assessment of the patient, analysing at a clinical, physical, psychological, and psychosocial level

Thus, taking into account these objectives, the consultation can be divided into three parts:

First part: *Review of the medical history*

In the initial phase of the consultation, the patient's medical history will be assessed and questions asked in the interest of verification for the surgical process. The following should be evaluated:

- Allergies, especially to iodinated contrast, antibiotics, or latex. If such allergies are present, the protocol established in each centre must be applied to ensure the safety of the patient on the day of the procedure and during their stay.
- Consult prior blood tests to observe the patient's situation: special attention should be paid to blood count, haemoglobin, renal function, and international normalised ratio (INR) in patients with oral anticoagulant vitamin K antagonists.
- For habitual treatment, if the patient takes oral anticoagulation, interruption of treatment should be evaluated prior to the intervention. To this end, the recommendation is to follow the guidelines of the Perioperative and Periprocedural Management of Antithrombotic Treatment Consensus Document of the Cardiovascular Thrombosis Group of the Spanish Society of Cardiology¹⁵.
- Verification of the necessary tests performed prior to TAVI: echocardiogram, CT angiography of the aorta and vascular accesses, and cardiac catheterisation. Check if they have been performed and their results included in the medical history.
- In some centres and depending on the type of access used in the TAVI procedure (e.g., subclavian, axillary, or apical access), the patient undergoing TAVI will require a «pre-anaesthesia visit»; if this is the case, check that it is carried out.

Part Two: *Procedure information and recommendations*

It is important that both the patient and their relatives understand the type of procedure to be performed in a clear and detailed way, the pre-, peri- and post-procedure circuit within their stay, approximate admission time, possible complications, as well as the necessary care at discharge, and signs of alarm once they are home (especially regarding vascular accesses). Correct optimisation of treatment, dietary measures, and regular physical exercise programs, as well as the identification and control of cardiovascular risk factors, is of vital importance. On the other hand, they should be provided with all recommendations before admission (fasting as of the night before, which medications they should take or which they should stop, what they should bring to the hospital, etc.). Also, doubts should be resolved and what discharge will be like be planned, in order to offer peace of mind and security to the patient and family members, so that they can organise. The objective of this second part is that the patient arrives in the best conditions and as well prepared as possible for the procedure and, after discharge, for home.

Third part: *Comprehensive assessment of the patient*

According to the 2021 European guidelines on aortic stenosis, the TAVI procedure is not recommended in patients with severe comorbidities when the intervention is unlikely to improve quality of life or survival at one year¹⁶. Therefore, we must know the different aspects of the patient that need to be assessed, as well as the tools available to do so.

In this part, different geriatric syndromes, self-care, frailty, and quality of life are assessed, which could be key to the acceptance or rejection of the patient's treatment, as well as predictors of complications or late hospital discharges, also serving to identify patients suitable to enter cardiac rehabilitation programs after the TAVI procedure.

In some centres, the geriatric assessment is carried out by geriatricians, but in more and more centres, it is the nurse who performs it together with nutritional and socio-family risk assessments, to evaluate the patient globally.

The tests or scales used are validated tools, some already studied in patients with aortic stenosis, and others validated in patients with general pathology. Their choice depends on the team of each hospital, always recommending those validated in this type of pathology, and if there are none, those used in a standardised way in the centre (**figure 3**).

Below are the different aspects to assess:

Frailty

Frailty is a geriatric syndrome that could be defined as a biological syndrome with reduced reserve and resistance to stressors, resulting from cumulative deficits in multiple physiological systems and causing vulnerability to adverse outcomes. It is characterised by reductions in muscle mass, strength, endurance, and activity level and is associated with higher mortality and morbidity rates¹⁷. Frailty can be modified and its evaluation should not solely be for prognosis, but also to carry out pre-rehabilitation interventions and recommendations for comprehensive cardiac rehabilitation based on the needs detected.

In recent years, different scales have been studied for

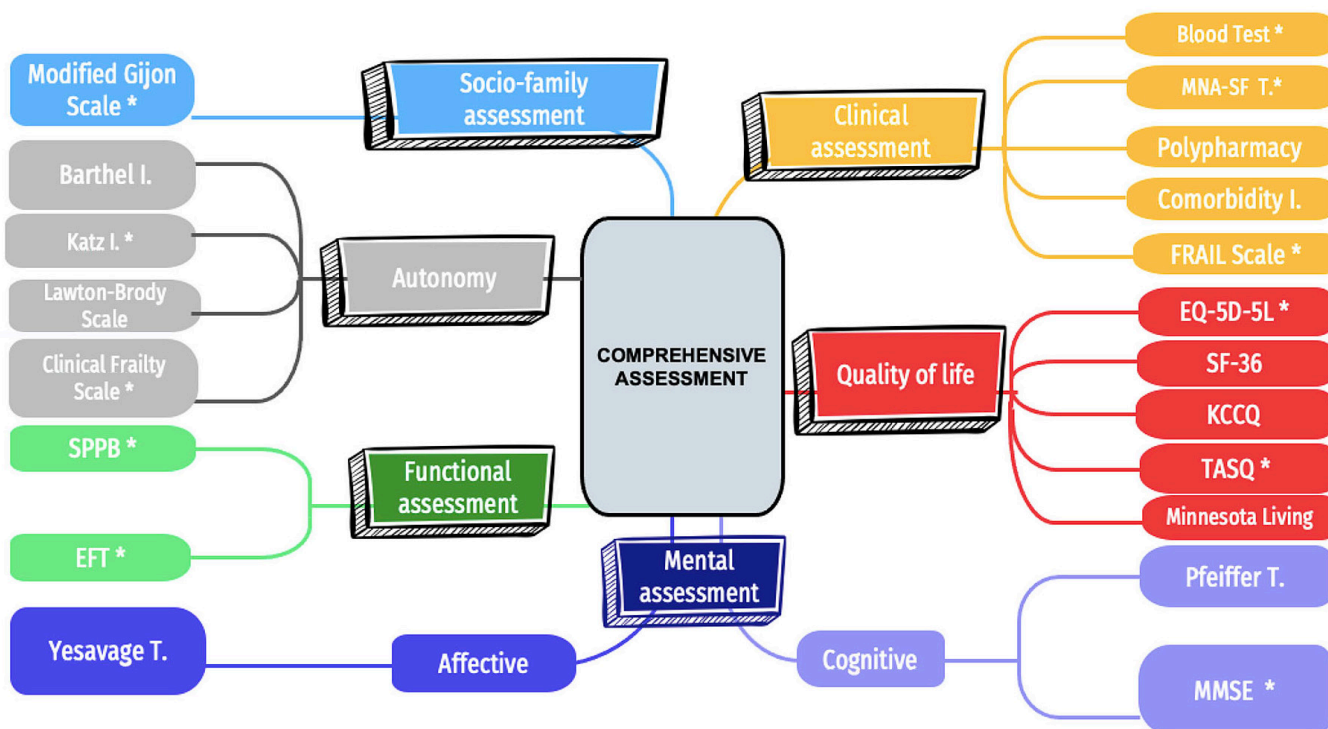


Figure 3. Comprehensive assessment scales. * Marks those most used in patients with aortic stenosis. Figure Ad hoc. SPPB: Short Physical Performance Battery; EFT: Essential Frailty Toolset; MNA-SF: Mini Nutritional Assessment Short Form; EQ-5D-5L: European Quality of Life Five Dimension Five Level Scale; SF-36: Short Form-36; KCCQ: Kansas City Cardiomyopathy; TASQ: Toronto Aortic Stenosis Quality of Life Questionnaire; MMSE: Mini-Mental State Examination.

screening frailty in the scenario of aortic stenosis looking for a valid, reliable, and easy-to-apply tool¹⁸. Some are excessively complex because they need require instrumentalisation, particular facilities, or because they are difficult to reproduce between different operators. Others do not cover all the necessary aspects or are based on self-evaluative questionnaires whose bias may be notorious¹⁹.

This practical table, published by Díez-Villanueva *et al.*,¹⁹ lists the main tools used for the measurement of frailty and its predictive capacity in aortic stenosis (figure 4).

The 2021 guidelines for the management of valvular disease of the Spanish Society of Cardiology¹⁶ reinforce this idea, proposing the *Essential Frailty Toolset* (EFT)²⁰⁻²¹ to evaluate frailty and the Katz index²²⁻²³ to evaluate dependence in basic activities of daily living, as another element to take into account for decision making.

Afilalo *et al.*,²⁰ also proposed the EFT scale to measure frailty and evaluate its impact on mortality and functional recovery capacity. The scale values range from 0 (absence of frailty) to 5 (maximum frailty) and evaluate 4 factors:

- Time spent getting up five times from a chair
- Cognitive impairment assessed by either of these two scales:

- MiniMental Test Examination
- Mini-Cog Test

- Haemoglobin
- Serum albumin

Another of the most widely used scales internationally is the *Short Physical Performance Battery* (SPPB)²⁴. It has the advantages of being easy to apply, with hardly any need for instruments, is reproducible between different operators, as well as having a predictive capacity of disability. These features

Index	Complexity	Physical tests	Laboratory tests	Predictive capacity in AS
FRAIL	+	-	-	?
Fried scale	++	+	-	+
Clinical Frailty Scale	+	-	-	+
Essential Frailty Toolset	+++	+	+	++
Green score	+++	+	+	+
Gait speed	++	+	-	+
SPPB	++	+	-	+

Figure 4. Advantages and disadvantages of frailty indexes in patients with aortic stenosis. Source: Díez-Villanueva *et al.*,¹⁹ SPPB: short physical performance battery; AS: aortic stenosis.

make it very favourable for applying in the pre-TAVI nursing consultation. It consists of a triple balance test (feet together, semi-tandem, and tandem), walking speed (2.4 or 4 meters), and getting up from a chair five times. It is important to respect the order of the tests since performing the sub-test of getting up from the chair first can fatigue the patient and negatively affect the other two sub-tests.

The *Clinical Frailty Scale*¹⁹ (CFS) is also widely used, it is based on the health professional's subjective assessment of functional status on 9 levels.

Dependence

As mentioned in the previous section, one of the scales recommended for evaluating dependence in patients with valvular disease is the *Katz index*²²⁻²³. This scale extracts a score from six dichotomous questions on activities of daily living. The presence of frailty is determined with a score of 2 (moderate disability is considered with 2-3 points and severe disability with 4-6).

Other scales widely used due to their ease and awareness are the *Barthel index*²⁵ for basic activities of daily living, and the *Lawton and Brody scale*²⁶ for fundamental activities of daily living.

Cognitive impairment

The presence of cognitive impairment is an aspect that must be assessed individually in each patient by the multidisciplinary team, the test most used being the Pfeiffer²⁷ test (*Short Portable Mental Status Questionnaire* [SPMSQ]) or the *Mini-Mental State Examination*²⁸ (MMSE).

Quality of life

There are several specific validated instruments to assess health-related quality of life (HRQL). Those most widely used in the literature for evaluating aortic stenosis patients are the *European Quality of Life Five Dimension Five Level Scale* [EQ-5D-5L], *Short Form-36* [SF36], *Minnesota Living with Heart Failure Questionnaire* [MLHFQ], and *Kansas City Cardiomyopathy* [KCCQ].

In recent years, the *Toronto Aortic Stenosis Quality of Life Questionnaire* [TASQ] has been designed and validated, being the first specific questionnaire for the evaluation of HRQL in patients with aortic stenosis.

● *European Quality of Life Five Dimension Five Level Scale* [EQ-5D-5L]:

This is a generic scale that provides a health status profile and is applicable to both patients and the general population. This questionnaire consists of two parts: the EQ-5D descriptive system and the visual analogue scale (EVA). There is a third element, an index of social values that are extracted from each state of health measured by the instrument.

The EQ-5D descriptive system contains five health dimensions: mobility, self-care, activities of daily living, pain/discomfort, and anxiety/depression.

It is an easy instrument to fill out, with short and simple questions²⁹.

● *Short-Form 36 Health Survey Questionnaire* [SF-36]:

This is a generic scale that provides a health status profile and is applicable to both patients and the general population.

The SF-36 is composed of 36 questions that assess both

positive and negative health states. Subsequently, new versions have been elaborated with fewer questions, however, the answers are more difficult for the patient to specify than in the 5D-5L³⁰.

● *Minnesota Living with Heart Failure Questionnaire* [MLWHFQ]

This questionnaire was designed in 1987 to measure the effects of heart failure (HF) and its treatment on the quality of life. The content of the questionnaire was selected to represent how HF and its treatment can physically, emotionally, socially, sexually, and economically affect the patient's quality of life. It is a self-administered Likert-type survey, consisting of 21 items³¹.

● *Kansas City Cardiomyopathy* [KCCQ]

The KCCQ is a questionnaire that, in addition to assessing the classic dimensions (physical, symptomatology, and social), incorporates an assessment of changes in symptoms and the level of self-care of these patients. This questionnaire is simple and quick to complete and can be self-administered by the patient. As for its structure, it comprises 23 items with Likert-type response options³².

● *Toronto Aortic Stenosis Quality of Life Questionnaire* [TASQ]

This new instrument was developed to overcome the shortcomings of the quality-of-life questionnaires available for this type of patient.

The questionnaire consists of five domains that address the physical, emotional, and social factors associated with aortic stenosis. The score for each of the 16 questions is based on a Likert scale with seven options³³.

Other factors that can be assessed are nutritional risk and socio-family assessment. In some centres, this is performed on all patients routinely, in others, only if some risk factor is detected in the patient.

- Socio-family assessment using the modified *Gijón scale*³⁴; allows the detection of situations of risk or social problems from five items.

- Nutritional assessment: screening to measure the risk of malnutrition, body mass index, and body fat percentage. Scales such as the *Mini Nutritional Assessment Short Form* [MNA-SF], the *Malnutrition Universal Screening Tool* [MUST], or the *COntrolling NUTritional status* [CONUT] can be used.

- Mood assessment via the Yesavage test.

POST-PROCEDURE CARE

After TAVI, it is necessary to perform follow-up from leaving the haemodynamic room to home care after discharge.

During hospital admission, after the intervention, both in critical care or hospitalisation, evolution and complication monitoring must be carried out. According to the possibilities of each centre, the TAVI nurse figure should monitor the evolution of the patient during the hospital process, carrying out at least the following activities¹¹:

- Constant dialogue with the nurse responsible for their treatment and care, affording educational support and resolving doubts at all times.

- Promote early mobilisation of the patient.

- Coordinate the final pacemaker implantation, if necessary.
- Ensure that an electrocardiogram and echocardiogram are performed before discharge.
- Schedule post-discharge tests and visits.
- Reinforce the educational concepts presented in the pre-TAVI consultation with the patient and their family and ensure their safety at all times, guaranteeing a safe and effective discharge process.

Nursing follow-up depends on each centre's protocol. Even so, early consultation (1 week to 3 months) and at least one long-term follow-up (6 months to 1 year) are recommended^{11,35-37}.

After hospital discharge, the evolution of symptoms and complications should be monitored according to established protocols. Depending on the patient's needs and each centre's protocol, a calendar of visits and diagnostic tests will be designed to this end. Follow-up can be carried out by nurses with previously designed supervision protocols and clinical trajectories.

In the post-TAVI nursing follow-up visit, one should:

- Reinforce the information received in the pre-TAVI consultation and hospital process, both to the patient and the family.
 - Evaluate needs after hospital discharge and schedule actions to cover them.
 - Comprehensively reassess the patient and compare with their previous state for different variables such as quality of life, autonomy, frailty, or mood.
 - Reassess the social factor and family support after discharge for care coverage.
 - Provide emotional support for the patient and their family.
 - Monitor complications previously identified at admission, detect late complications, and manage the diagnosis and treatment circuit.
 - Follow up of patients included, if applicable, in the cardiac rehabilitation program to improve functional capacity, quality of life, and controlling cardiovascular risk factors associated with the TAVI patient³⁸.
 - Assess patient satisfaction and experience during their TAVI «*Patient Journey*»³⁹.
- Throughout the follow-up, it should be taken into account that posterior and late complications may arise after the procedure. Therefore, close monitoring is essential to quickly identify these potential complications and handle them correctly. Thus, among the most frequent TAVI complications that should be checked at follow-up, these stand out⁴⁰⁻⁴³:
- Arrhythmic disorder
 - During TAVI follow-up, if electrocardiographic control is performed, the presence of atrioventricular and branch blocks, PR interval length, and the shape and length of the QRS interval should be analysed and subsequently compared with the electrocardiogram at hospital discharge. If a pathological electrocardiogram is observed, the care required, according to each centre, should be arranged.
 - Stroke or transient ischemic attacks
 - Via the follow-up consultation, neuromotor functions

should be assessed after the intervention and any incidence detected.

- Major and minor vascular complications
 - It is necessary to carry out a control of the vascular accesses to verify their correct healing and detect the presence of indurations and haematomas. The corresponding diagnostic and treatment circuit should be arranged if it does not follow a linear and standard process.
- Acute renal failure
 - Analytical control after discharge
- Prosthetic dysfunction and/or paravalvular insufficiency
 - Control of the course and symptomatology allows us to suspect this complication; it must be verified via echocardiography.

In the control of symptomatology, it is necessary to detect the presence of dyspnea and quantify its degree, fatigue, malleolar oedema, chest pain, and dizziness and evaluate their improvement compared with the previous control of the pre-TAVI consultation. It is appropriate to know the evolution of the pre- and post-intervention NYHA functional class.

CONCLUSIONS

The increasing number of patients with aortic stenosis, together with the aging of the population and expansion of the indication for TAVI, has made it necessary to establish programs to organise the selection and follow-up of patients suitable for this intervention in different centres.

Current scientific evidence shows the benefits that the implementation of the TAVI nurse figure can entail, and highlight the need to incorporate it into TAVI programs, which could translate into a better optimisation of resources, favouring communication and decision-making, thus obtaining better health outcomes and patient satisfaction.

The TAVI nurse figure must place the nurse between the patient and the institution, with the aim of turning the care process into a continuum, where healthcare fissures are minimised. It is important to make the patient participate in their process and know how to transmit all the information, from diagnosis to resolution of their process or acceptance of their new state of health. To this end, the involvement and commitment of health administrations, centre directors, and scientific societies that support and collaborate in this type of evidence-based action are necessary.

This document brings together experts from the SNAC to agree on the nursing care to administer to a patient with aortic valve pathology, candidate for TAVI, and establishes specific nursing recommendations in pre-, peri- and post-TAVI care.

The challenge in the coming years is to implement this figure in a large part of our country's centres, with a quality register that can be evaluated with indicators that demonstrate the effectiveness of this figure.

CONFLICT OF INTEREST

None.

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