Mini-Review

The role of sympathectomy in long QT syndrome

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Abstract: Long QT syndrome (LQTS) is an uncommon and potentially fatal cardiac channelopathy. Treatment options can be medical with β-blockers or surgical with implantable cardioverter defibrillator (ICD) implantations and left cardiac sympathetic denervation (LCSD). Purpose of this paper is through a literature review to identify the management algorithm and the role of sympathectomy in LQTS.

Keywords: Sympathectomy; long QT syndrome (LQTS); video-assisted thoracoscopic surgery (VATS); Horner syndrome

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Introduction

Long QT syndrome (LQTS) represents of a heterogeneous family of disorders characterized by delayed cardiac repolarization and a propensity to syncope and sudden cardiac death (1). Other symptoms include palpitations and seizures. The electrocardiography (ECG) in individuals with LQTS reveals a prolonged QT interval. The QT interval is measured in lead II of a 12-lead ECG from the onset of the QRS complex to the end of the T wave. The QTc (corrected for HR) can be calculated (QTc = QT interval + square root of the RR interval). In children 1 to 15 years old, a QTc exceeding 0.46 seconds is considered prolonged. Otherwise, a QTc is prolonged if exceeding 0.47 seconds in women and 0.45 seconds in men. A study from 2009 demonstrated that the prevalence is ~1:2,500 births (2). Three major genes are responsible for 80% of total genotyped patients with LQTS (3).

The management of LQTS is mainly pharmaceutical with β-blockers. For patients with LQTS but not syncope, complex ventricular arrhythmias, a family history of sudden cardiac death, or a QTc interval of 500 milliseconds or longer, no therapy or treatment with a beta blocker is generally recommended. In asymptomatic patients with complex ventricular arrhythmias, a family history of early sudden cardiac death, or a QTc interval of 500 milliseconds or longer, beta adrenoceptor blocker such as propranolol or nadolol at maximally tolerated doses is recommended (4-6). Therapy with β-blockers is associated with a significant reduction in cardiac events in LQTS probands and in the affected family members (7). A survey based on an electronic questionnaire sent out to the European Heart Rhythm Association (EHRA) Research network showed that the first-line therapy in LQTS is medication (76%) followed by a combination of drugs and implantable cardioverter defibrillator (ICD) (19%) (8). The indications for an ICD, as expressed in the HRS/EHRA/APHRS expert consensus statement on the diagnosis and management of patients with inherited primary arrhythmia syndromes, are for patients with a diagnosis of LQTS who are survivors of a cardiac arrest (Class I) or for patients with a diagnosis of LQTS who experience recurrent syncopal events while on β-blocker therapy (Class IIa) (9). The implantation of an ICD device should be vigorously considered for young and active individuals, as such a procedure may lead to various significant sequelae, for example infection, malfunction, inappropriate shock deliveries, and subsequent anxiety (10).

With this in mind, data from the European Long-QT syndrome implantable cardioverter-defibrillator (LQTS ICD) registry were gathered and a novel scoring system was proposed to properly select the patients who may benefit from an ICD implantation (11).

The role of left cardiac sympathetic denervation (LSCD) or sympathectomy has been established as an effective, but rarely performed procedure (8). A literature review in Medline was performed with the following search criteria: (sympathectomy.mp) and (long QT syndrome.mp). The search was limited to humans and the English language and fifty papers were found. From the papers found using the reported search strategy, five were identified providing the best evidence for the purpose of our paper. These papers were retrospective studies. The first procedures were performed in the 1970s (12), but it wasn't until 1991 that the first worldwide report identified 85 patients globally that had undergone LCSD (13). Schwartz *et al.* concluded in that paper that LSCD is a very effective therapy for patients who present with syncope or cardiac arrest despite the use of β-blockers. The paper demonstrated that the symptomatic patients were 45% (from 99% initially), the events per patient were 1±3(from 22±32) and the number of patient with five or more events fell down to 10% (from 71%). It took another 13 years for one more paper by Schwartz *et al.* with 147 LQTS patients who underwent LCSD (14). They concluded that the LCSD procedure leads to a significant reduction in the incidence of aborted cardiac arrests and syncope in high risk LQTS patient when compared to pre-LCSD events. Their population was highly symptomatic (99%), 48% of them had a cardiac arrest and 75% were treated with β-blockers, but even so remained symptomatic. Following the intervention, 46% stayed asymptomatic and the number of cardiac events per year per patient reduced by 91%. They also noticed that the percentage of patients with >5 cardiac events declined from 55% to 8%. They proposed that LCSD should be considered for patients with recurrent syncope episodes under maximal pharmacological treatment and for patients who suffer arrhythmia storms in the presence of an ICD. More studies have emerged following that paper, but in the majority of them some 20 to 50% of the patients do remain symptomatic having had LCSD (15-22) and there are also studies that identified that almost 50% of high-risk patients may experience more than one cardiac event post LCSD (14,20). Atallah *et al.* (17) described that four patients with LQTS underwent VATS LCSD. All of them met the criteria for an ICD implantation and 3 out of 4 met the criteria for LCSD. Their results were comparable with Schwartz's study. Collura *et al.* (15) performed LCSD for 20 patients, 11 of which needed it for secondary prevention (average age 8.5±12.6 years; range, 0 to 42 years; average QTc 549±75 ms; range, 451 to 687 ms) and 9 had it for primary prevention (average age 9.8±5.3 years; range, 1 to 17 years; average QTc 480±40 ms; range, 430 to 536 ms). They reported no surgical complications perioperatively, but due to poor follow-up (patients not returning for their 6-month evaluation), they stated that impressive QT-attenuating effects at 6-month follow-up have been observed among some of their patients. Li *et al.* (22) also described 11 VATS-LCSD cases, all of them with LQTS. At follow-up, 7 of these 11 patients were free of cardiac events, 2 of them had reduced frequency of events, but unfortunately one of them experienced an increase of events in spite of the procedure and one of them died less than 2 years following the procedure, a 6-year-old boy who suffered from malignant ventricular arrhythmias. All of the above mentioned papers suggest that LCSD cannot be regarded as a totally curative procedure, but rather a procedure that helps patients deal with their symptoms.

The HRS/EHRA/APHRS expert consensus (9) has recommended for LCSD to be performed in high-risk patients with a diagnosis of LQTS in whom: (I) ICD therapy is contraindicated or refused and/or (II) β-blockers are either not effective in preventing syncope/arrhythmias, not tolerated, not accepted or contraindicated (Class I) and it may be useful in patients with a diagnosis of LQTS who experience breakthrough events while on therapy with β-blockers/ICD (Class IIa).

The techniques and approaches to perform an LCSD have evolved over the years. Left stellectomy and left cervicothoracic sympathectomy (which is, indeed, a left stellectomy and removal of the first four or five thoracic ganglia) have now been abandoned altogether, as they are both associated with Horner's syndrome and the former also provides very little cardiac denervation. Nowadays, the high thoracic left sympathectomy involves an ablation of the lower half or lower third of the left stellate ganglion, together with the thoracic ganglia T2 to T4. This technique provides a good denervation result without the high occurrence of Horner's, as most of the sympathetic fibres directed to the ocular region usually cross the upper portion of the left stellate ganglion and thus are spared (14). The original approach of open thoracotomy (anterior transthoracic or transaxillary) that was utilised at the start and middle of the twentieth century is now replaced by the

minimally invasive approach of video-assisted thoracoscopic LCSD (VATS-LCSD) (15,17-19,21,22). Some centres opt out for a supraclavicular retropleural approach, making thoracic drainage unnecessary (23). The commonest side effects following LCSD are dry left arm, face and forehead with intense sweating of the right side. Horner's syndrome or ptosis of the eyelid is now rare and in most cases only temporary.

Conclusions

Medical and/or device therapy still represent important therapeutic modalities in the management of patients with LQTS, LCSD has a significant role in minimising the arrhythmia load in LQTS patients, but not obliterating it altogether, with minimal acute and long term complications. Careful clinical judgement for the substrate of patients who will benefit from LCSD is of the utmost significance.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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