

# Outcomes of Cardiac-Physiologic Studies at Queen Alia Heart Institute. A Three Year Experience

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## ABSTRACT

**Objective:** To evaluate the outcomes of cardiac -physiologic studies and interventions for a variety of cardiac arrhythmias at Queen Alia Heart Institute and to compare our status with other cardiac units in multi-institutional centers.

**Methods:** The records of patients who had electro-physiologic studies at Queen Alia Heart Institute in the period between January 2014 and December 2016 were reviewed. Endpoints included were: Early mortality, heart block, groin vascular complications and cardiac perforations.

**Results:** A total of Eight-hundred-twenty-five patients were included in this retro-spective study, 64% of the patients were males, and the age range in the whole cohort was between 9-86 years (mean 46 years). The indications for the electro-physiologic studies were: Supra-ventricular tachycardia (505 patients), Wolf Parkinson White Syndrome (223 patients), Ventricular Tachycardia (22 patients), Sinus nodal dysfunction or atrio-ventricular nodal conduction disturbances (28 patients) and syncope (29 patients). None of the 825 patients had early mortality. Four patients developed complete heart block, 3 of them followed atrioventricular nodal reentrant tachycardia ablation while the fourth was after parahisian pathway ablation. Three patients had groin hematomas, none of these needed surgical intervention. One patient had cardiac perforation , and one patient had simple pneumothorax which was treated using tube thoracostomy. The average in-hospital stay was 2 days.

**Conclusion:** Cardiac Studies and interventions are viable diagnostic and therapeutic options in cardiac arrhythmias and can be performed safely with minimal risks.

**Key words:** Catheter, Cardiac arrhythmias, Complications, Electrophysiology.

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### Introduction

Cardiac electrophysiology study is a minimally invasive procedure that assess the electrical activity and conduction pathways of the heart. During Electrophysiological Study (EPS), cardiac intervals in sinus rhythm as well as supraventricular and ventricular arrhythmias are recorded. <sup>(1)</sup>The study is indicated to investigate the cause, location, and best treatment for various abnormal heart rhythms. Electrophysiology study is done using a single or multiple catheters situated within the heart. <sup>(2)</sup> When the catheters are in and all preparations are complete elsewhere in

the lab, the Electrophysiological study begins. <sup>(1-3)</sup> Pacing the heart is the next step, trying to provoke arrhythmias and reproduce the conditions that have resulted in the patient's placement in the study. If at any step during the Electrophysiological study the electrophysiologist finds the source of the abnormal electrical activity, he/she may try to ablate that spot. This is done using high-energy radio frequencies. As with any medical procedure, cardiac electrophysiology study has a list of possible complications like damage or trauma to a blood vessel, infection, hematoma at the site(s) of the puncture(s),

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cardiac perforation and damage to the conduction system, which may require a permanent pacemaker .

## Methods

Our cardiac center Queen Alia Heart Institute / Royal Medical Services is the major referral center for Jordanian patients who need management for Tachy and Brady arrhythmias

### *Patient's selection:*

All the patients who were referred to Queen Alia Heart institute during the period from January 2014 till December 2016 with supraventricular tachycardia including atrioventricular nodal reentrant tachycardia (AVNRT), Atrioventricular reentrant tachycardia (AVRT), Wolf Parkinson white syndrome (WPW), atrial fibrillation, flutter and right ventricular outflow tachycardia, in addition to all patients who were referred for bradycardia, heart block with or without symptoms were included in our retrospective descriptive analysis. The indications for electrophysiology study are shown in Table I.

### *Electrophysiological procedure:*

At our Electrophysiology laboratory each patient gets conscious sedation using Midazolam, Morphine and occasionally Propofol except patients undergoing atrial fibrillation (cryoablation) and patients undergoing Right Ventricular Outflow Tract (RVOT) ablation who received general anesthesia. Blood pressure, ECG and pulse oxymetry are monitored during the whole

procedure. There are two consultants electrophysiologists at Queen Alia Heart Institute using the same standard setup for Electrophysiological study, in which three Quadripolar electrode catheters are inserted via the femoral vein and positioned in the high right atrium, His bundle recording and Right Ventricular (RV) apex. Deca catheter is usually placed through the right subclavian access, in addition to the ablation catheter when needed .The ablation catheter access from the right femoral vein if it is right sided accessory pathway and from the right femoral artery (retrograde approach) if left sided accessory pathway. All patients with tachy arrhythmias underwent standard Electrophysiological Study. Different pacing maneuvers were used and after proper interpretations ablation catheter were placed and ablation was done accordingly (slow pathway ablation for AVNRT, accessory pathways for AVRT including concealed and WPW were ablated). Using 4 mm blazer or medium sweep catheter with different radiofrequency energy source. In cases like atrial flutter and in postero-septal accessory pathway 8 mm ablation catheter was occasionally used. Atrial fibrillation ablation was done by pulmonary vein isolation using only cryoablation balloon. Right ventricular outflow tachycardia was ablated using Saint Jude non contact mapping (EnSite balloon). We analyzed the complications of EPS during hospitalization and after 6 months for just at one visit.

**Table I:** Electrophysiology study indication:

<b>Indications</b>	<b>Patients, Number(%)</b>
Supraventricular tachycardia	505, (61.2%)
Wolff Parkinson White syndrome	223, (27%)
Atrial fibrillation	18, (2.2%)
Ventricular tachycardia	22, (2.7%)
Sinus node dysfunction/AV node conduction disturbance	28, (3.4%)
Syncope	29, (3.5%)

## Results

In this study we had a total of 825 patients who underwent Electrophysiological Study with or without ablation. 528 males (64%), 297 females (36%). Patients age ranged from 8-86 years with a mean age of 46 years old. Of the 825 patients who underwent an EPS

diagnoses were reached in 778 patients (87.3%). Total of 505 SVT 223 WPW Patients were ablated, 22 patients with Ventricular Tachycardia were ablated using EnSite balloon and 18 patients with Atrial Fibrillation were ablated using Cryoablation Balloon. Of the 825 patients who underwent

Electrophysiological Study with or without ablation 9 patients had complications (Table II) 3 patients had complete heart block needed pacing and one patient had second degree heart block that recovered spontaneously. We

had one case of cardiac perforation during trans septal puncture in one of our A Fib ablation, 3 patients had hematomas and 1 patient had pneumothorax.

**Table II:** Electrophysiology study complications:

	Supra ventricular tachycardia	Wolff Parkinson white syndrome	Ventricular tachycardia	Atrial fibrillation	Diagnostic
<b>Hematoma (0.36%)</b>	-	2	-	1	-
<b>Pneumothorax (6.1%)</b>	1	-	-	-	-
<b>Heart block (0.48%)</b>	2	2	-	-	-
<b>Perforation (hemopericardium)(0.1%)</b>	-	-	-	1	-
<b>Tamponade</b>	-	-	-	-	-

## Discussion

Electrophysiological Studies are much less traumatic than they seem to be, by using the appropriate equipment and the adequate experience of the physician of the staff. <sup>(4)</sup> The most common complications that can occur are vascular access problems at the puncture site like bleeding with or without hematoma, arterio- venous fistula and infections. <sup>(5)</sup> Other complications include Cardiac arrhythmias, (atrial fibrillations, ventricular tachycardia), hypotension, pericardial effusion with or without tamponade, pneumothorax, heart block and death. <sup>(4,5)</sup> Despite the increasingly wide applications of this procedure there is not much information about the complications and risks associated with it in Jordan. Arrhythmic complications of Electrophysiological Study were bradycardia or tachycardia that persisted or recurred, the definition excluded the induction of arrhythmias that were clinically relevant to the patient's indications for the study. <sup>(6)</sup> The risk of complications in Electrophysiological Study is low in literature. <sup>(1,3,6)</sup> Di Marco and colleagues reported that Electrophysiological Study carry an acceptable low incidence of complications. <sup>(3)</sup> The complications rate was 5.1% in the multi center European Radiofrequency ablation survey. A prospective analyses of 1000 consecutive patients the rates of Electrophysiology complications was low and acceptable; they reported a higher incidence of arterial injury than others because of multiple catheter insertions in the adjacent veins according to their explanation. <sup>(6)</sup> The rates of major

complications were 1.04% in Spanish electrophysiology laboratory in 2005. In our study, the rate of major complication was 0.7% and the total complication rate was 1% which is comparable to these studies. In another study conducted by Kamil Adalet the rate of complications was 7.6% which is much higher than ours. <sup>(7)</sup> We also reported fewer incidences of puncture site complications. Concerning rate of deaths, Horowitz et al. observed rate of mortality of 0.01% and in Spanish records it was 0.03%, Fewer deaths have also been reported in previous clinical cardiac Electrophysiology studies. <sup>(5)</sup> For example in the multi center European Radiofrequency ablation survey they reported four deaths. In our study we had no mortality. In addition Prashant Bharadwaj et al. found the complication rate to be 0.45% in 10 years at their EP lab. <sup>(9)</sup> In our study at Queen Alia Heart Institute from the year 2014-2017 the rate of complications both minor and major were very low.

### *Study strengths and limitations:*

This is the first study to report complications of electrophysiology study in our area. The main strength of this study is that it is the largest reported analysis of Electrophysiology study complications in this region. In this study all complications of Electrophysiology study were retrospectively analyzed during hospitalization and follow up period which is at six months visit, so some complications that occurred after discharged till six months might not been detected. This study is a one center experience and we would like to have

studies done in other centers in this region in the near future.

## Conclusion

Electrophysiology study is considered a minimally invasive procedure with excellent success rates and various complications. In our study at Queen Alia Heart Institute as a tertiary center with high volume and extensive experience the complication rates were very low.

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