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Implanting Loop Recorders in a Hospital Unit versus the Electrophysiology Laboratory: A Retrospective Chart Review

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ABSTRACT

Introduction: Cardiac arrhythmias and unexplained syncopal episodes remain a challenge for clinicians to diagnose. The recent creation of the smallest Implantable Loop Recorder (ILR) assists in identifying the causes behind cardiac and neurological events. The current study aimed to compare the practice of implanting loop recorders at the bedside in the Cardiac and Vascular Care Unit (CVCU) to implantations in the Electrophysiology Laboratory (EP Lab).

Methods: This study was a retrospective review of electronic medical records. Data abstraction included implantation dates, time of admission and discharge, length of stay (LOS), number of healthcare staff involved, and cost of the procedure.

Results: Over ten months, 63 ILRs were implanted in the EP Lab and 131 ILRs at the bedside. Patients LOS, on average, in the EP Lab was five hours versus four hours at the bedside. Five staff were required to implant the ILR in the EP Lab, and two at the bedside. Based on 63 cases in the EP Lab, the hospital generated revenue of \$395,640, whereas the 131 cases at the bedside generated revenue of \$822,680. This resulted in an increase in revenue of \$427,040.

Discussion: A higher number of procedures were done at the bedside leading to a decreased average length of stay, number of staff involved, cost of the procedure, and a reduction in waiting time for patient admission and discharge.

Keywords: Bedside, Cardiac and Vascular Care Unit, Costs, Electrophysiology laboratory, Implantable loop recorder

INTRODUCTION

Cardiac arrhythmias, unexplained syncopal episodes, and cryptogenic stroke remain a challenge for clinicians to diagnose (Olsen, Biering-Sørensen, & Krieger, 2015). Early diagnostic methods failed to detect these isolated incidents when occurring unexpectedly (Shanmugam & Liew, 2012). Cardiac monitoring, a tool to counteract this challenge shifted from the traditional 12 lead electrocardiographs in-patient monitoring to Holter device monitoring. The introduction of the implantable loop recorders (ILRs) was a turning point in arrhythmia management (Olsen et al., 2015).

The first ILRs were developed in the 1980s (Tomson & Passman, 2015). They are used in the long term monitoring of patients with arrhythmias (Mittal et

al., 2015). Patients who suffered an unexplained syncopal episode would benefit from the insertion of an ILR as a first step in diagnosing the need for a permanent pacemaker implantation (Sheldon, 2013).

Until the early 2000s, these devices were implanted in the electrophysiology laboratory (EP Lab) or the operating room (OR). Krahn, Klein, Yee, and Skanes (2004) indicated that this procedure was completed by cardiac surgeons or interventional cardiologists. They further compared the process of implantation to a pacemaker insertion. Under anesthesia, physicians created a pocket to lodge the sizeable device (Grubb, Welch, Kanjwal, Karabin, & Kanjwal, 2010). The procedure done under sedation lasted for 20-30 minutes (Mofrad, 2012, p. e473). In the 21st Century, experts in the field designed the smallest existing loop recorders (Tomson & Passman, 2015). The newest implantable loop re-

orders (ILRs) are “87% smaller than their predecessor” (Pürerfellner, Sanders, Pokushalov, Di Bacco, Bergemann, & Dekker, 2015, p.1114). Implantable loop recorders are inserted subcutaneously during a minimally invasive procedure according to manufacturer’s recommendations (Maines et al., 2018).

A literature review revealed information on the implantation of ILRs in the EP Lab, the OR, with few implants inserted outside the hospital settings (Pachulski et al., 2013; Krahn et al., 2004; Yee & Skanes, 2004). Some studies exist on implanting ILRs outside the EP Lab and the OR (Pachulski, Cockrell, Solomon, Yang, & Rogers, 2013; Pürerfellner et al., 2015). Hospital leaders began investigating the possibility of implanting ILRs in another hospital setting. Wong et al. (2016) evaluated the effects on patients with ILRs implanted in the EP Lab versus in a sterile room and found no significant differences in patient outcomes. Maines et al. (2018), Miracapillo et al. (2016) concluded that inserting an ILR is a simple, safe, and quick procedure.

Implantable loop recorders help in the establishment of more precise cardiac diagnosing by monitoring patients’ symptoms long term out of the hospital (Cvetković et al., 2016; Olsen et al., 2015). ILRs allow the patients to become more engaged in their own care and aware of their health status (Olsen et al., 2015). ILRs longer battery life, the ability to monitor patients 24/7, and ease of insertion gives the electrophysiologists the option to perform implants outside of the EP Lab or OR (Gunda et al., 2015).

Little is known about the advantages of implanting the device at the bedside in an outpatient unit. The use of a descriptive retrospective chart review, in a Magnet® hospital, located in South Florida, provided additional information which helped fill the existing gap in the current literature. The research hypothesis was that implantation of ILRs at the bedside would result in cost savings, decreased length of stay (LOS), and an increase in hospitals’ return on investment (ROI).

METHODS

Study Design and Sample

This retrospective chart review included a convenience sample of medical charts. A total of $N=194$ electronic medical charts were reviewed from January 1, 2015, to January 29, 2016. Sixty-three charts from patients who had ILRs implanted in the EP Lab and

131 from patients with ILRs implanted at the bedside in the Cardiac Vascular Care Unit (CVCU) met the inclusion criteria. ILRs implanted in the OR and patients scheduled for multiple procedures were excluded. The same EP technician was used for all implantations. The research team reviewed the data to identify whether there were differences in patients’ LOS, duration of the procedure, hospital costs, and use of staff resources when implanting ILRs in CVCU versus the EP Lab. The research team also examined if there would be an increase in the number of procedures based on procedure setting (EP Lab vs. bedside) possibly increasing the hospital’s ROI, which could affect the decision of hospital administrators in their choice of implant setting.

Data Collection/Analysis

A data abstraction tool was developed to include implantation dates, time of patient admission and discharge, LOS, number of healthcare staff involved, and cost per procedure. Data were recorded in a manner to protect subjects’ identification with no possible link to the subjects. Investigators were trained on how to collect the data prior to conducting the study to ensure standardization and consistency of the process. Data analysis was performed using the Statistical Package for Social Sciences (SPSS) version 24.

Ethical Considerations

This study received approval from the hospital Institutional Review Board (IRB).

RESULTS

The results from this study revealed that the average length of stay (LOS) from admission to discharge for patients in the EP Lab was five hours or 295 minutes ($M=294.84$, $SD= 106.9$) and four hours or 221 minutes ($M= 221.43$, $SD= 104.08$) for patients in CVCU. Furthermore, fewer staff were required ($n = 2$, $M=2.02$, $SD=.26$) to do the procedure in CVCU than in the EP Lab ($n=5$, $M=4.73$, $SD=.91$). Over ten months, 63 ILRs were done in the EP Lab compared to 131 in CVCU (Table 1).

Cost-related Results:

The number of staff required to implant the ILR in the EP Lab was five full-time employees: one CVCU RN, two EP RNs, and two EP technicians. Bedside procedure for ILR included two staff: one CVCU RN

Table 1

Loop Recorders in EP Lab vs CVCU

Procedure Setting	Months	Patients	Length of Stay (hours)	Length of Stay (minutes)	Staff per Procedure	Staff
				Mean (SD)		Mean (SD)
EP Lab	10	63	5	294.84 (106.9)	5	4.73(.91)
CVCU	10	131	4	221.43 (104.08)	2	2.02 (.26)

Note. EP: Electrophysiology, CVCU: Cardiac and Vascular Unit, SD: standard deviation

Table 2

Labor Charges in the EP Lab vs CVCU

	Procedure in EP Lab			Procedure at Bedside			
	<u>EP RN</u>	<u>CVCU RN</u>	<u>EP Tech</u>	<u>Total charges</u>	<u>CVCU RN</u>	<u>EP Tech</u>	<u>Total Charges</u>
Salary per hour (\$)	51.36	45.00	39.08		45.00	39.08	
FTEs	2	1	2		1	1	
Total Cost per hour	102.72	45.00	78.16	225.88	45.00	39.08	84.08

Note. EP: Electrophysiology, CVCU: Cardiac and Vascular Unit, FTEs= Full Time Equivalent staff

and one EP technician. CVCU RN average hourly salary was \$45.00 at the bedside and \$51.36 in the EP Lab. The EP technician hourly salary average was \$39.08 for both bedside procedure and EP Lab (Table 2). The cost to perform the ILR procedure in the EP Lab was more than the cost to perform the same procedure in CVCU. Table 3 shows the labor charges broken down into 15-minute increments.

Table 3

Labor Charges in 15 Minute Increments per Procedure

	Procedures in EP Lab	Procedures in CVCU
Total Charges per Hour (\$)	225.88	84.08
Charges per 15 minutes (\$)	56.47	21.02

Note. EP: Electrophysiology, CVCU: Cardiac and Vascular Unit

The total labor cost per hour to do the implantation in the EP Lab was \$14,230.44 (\$225.88 x 63 cases). The total labor cost to do 63 ILRs in CVCU was \$5,297.04 (\$84.08 x 63 cases). This would result in a cost saving of \$8,883.00.

The charge for performing an ILR was estimated at \$6,280. Therefore, the 63 cases done in the EP Lab over ten months generated revenue of \$395,640, whereas the 131 cases in CVCU generated revenue of \$822,680. There were 68 (131-63) more cases performed at the bedside with an increase in revenue of \$427,040 (68 cases x \$6280).

DISCUSSION

The purpose of this study was to compare the practice of implanting loop recorders at the bedside to implantations in the EP Lab. Findings from this study

show that insertion of ILRs at the bedside can be done faster and with less staff compared to doing the same procedure in the EP Lab. These results are congruent with Kanters et al. (2016), who found that the ILRs can be implanted in areas other than the catheterization laboratory with less staff and equipment. While implanting the ILR in the patients' rooms, the EP Lab can be reserved for more invasive procedures. Thus, patients, who need to undergo more complex procedures would have to wait less for the EP Lab. Kipp et al. (2017) stated that implanting ILRs in a non-surgical location facilitated physicians' daily workflow and availability of clinical staff. Nguyen et al. (2017) indicated that implanting ILRs in an outpatient site allocates time and resources for costly and complex procedures, improving in-hospital productivity and ROI.

Overall, an EP physician will have less delay between patients since the patient is already in a hospital room. There is no delay waiting for the EP lab to be cleaned and prepared between patients. Additionally, the same staff will conduct pre and post procedure care, reducing the number of staff needed for the procedure. Kanters et al. (2015) reported that changing the setting of the implantation and practice efficiencies resulted in cost savings in hospitals in the Netherlands, France, and the United Kingdom.

Patients' average LOS decreased since there was no need for post-sedation monitoring post procedure. The electrophysiologist inserts the ILRs using a local anesthetic agent and no intravenous anesthetic agents are administered. This finding is in agreement with Wong et al. (2016) who mentioned that using only a local anesthetic agent during implantation resulted in patients being discharged home sooner. Additionally, researchers have found that patients who undergo ILR implantation with local anesthesia experience increased satisfaction and well-being (Leahy & Davenport, 2015). Patients could fulfill routine activities of daily living, as tolerated, after the procedure (Leahy & Davenport, 2015). Also, implanting ILRs at the bedside vs. the EP lab decreases patients' length of stay and subsequently improve patient satisfaction (Nguyen et al., 2017; Steffel, Wright, Schafer, Rashid-

Fadel, & Lewalter, 2017).

Some studies have shown that ILRs can be safely implanted at the bedside (Kipp et al., 2017; Wong et al., 2016; Mittal et al., 2015; Pachulski et al., 2013, Suneet et al., 2015). The new knowledge generated by findings from the current study may prove beneficial to health care providers, patients, and hospitals. The insertion of ILRs in CVCU resulted in decreased cost, patients' LOS, number of staff involved, and increased number of procedures and revenue. Health care leaders may consider making ILRs implantation at the bedside the new standard of care.

LIMITATIONS

The main strength of this study is the cost analysis comparison, which has great implications for patients, physicians, hospitals, health insurances, and the healthcare system in general. However, a limitation was that a comparison of adverse events following the procedure was not done. Since patients were given the usual post-surgery discharge instructions informing them to look for signs/symptoms of infection and follow-up appointments with their physicians, hospital medical charts did not contain follow-up information. Additionally, a convenience sample of medical charts was used for this research. Nonetheless, a power analysis showed that 194 medical charts were an adequate sample size for this study. Future studies should explore patient outcomes of ILR insertion in different settings.

IMPLICATIONS FOR NURSING PRACTICE

The findings from the present study have several of implications for nursing practice and hospital administrators. With new legislation for reimbursements tied to patient satisfaction, hospitals are faced with the daunting task to implement cost saving and budget-friendly interventions (Steffel et al., 2017). Patient satisfaction, for example, has been increasingly popular in influencing reimbursement. Having the ILR implanted at the bedside in a unit such as CVCU instead of the EP Lab can result in quicker discharge times and increased patient satisfaction.

The process for implantation requires less intervention in the unit. There is no need for the placement of an intravenous catheter or the prepping of an entire EP suite; therefore, the procedure time is reduced. Moreover, patients LOS in the hospital decreases because recovery with local anesthetics occurs faster. The less invasive nature of the procedure combined with the decreased LOS can increase patient satisfaction (Steffel et al., 2017).

The EP Lab is a high revenue generating unit for hospitals. Implanting the device at the bedside has proven more cost-effective. Performing bedside implantation of ILRs would allow interventional cardiologists to implant more devices on a daily basis than what can be performed in the EP Lab. The increase in

implantation procedures, combined with the lower cost of performing a bedside procedure, will in turn increase revenue for the hospitals and physicians. Implanting ILRs at the bedside is worthwhile (Rogers et al., 2014).

CONCLUSION

Decreased costs and increased revenues are not the only indications for implanting ILRs at the bedside. Previous research confirms that bedside implantation of ILRs is safe, and complications are minimal (Suneet et al., 2015). Conducting ILRs at the bedside would reduce the amount of time between room cleanings. This results in increased patient volume, as the facility is able to accommodate more cases and generate more revenue. With the improved efficiency of bedside insertion of ILRs, compared to the same procedures done in an EP lab, bedside insertion may soon become the standard of care for patients requiring long term cardiac monitoring.

DECLARATION OF INTEREST:

The authors have no conflicts of interest to disclose.

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