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Short Communication
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Minimizing Door to Treatment Time: Creating a "Go Bag" for External Ventricular Drain Placement

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Abstract

Introduction: An External Ventricular Drain (EVD) is used to divert Cerebrospinal Fluid (CSF) away from the ventricles when there is obstruction of normal flow. The most urgent indication for an EVD is acute obstructive hydrocephalus causing brain herniation. The Neuro-Medicine Intensive Care Units (NMICU) multi-disciplinary Unit based Perform Program (UPP) team hypothesized an EVD "Go Bag" containing all the equipment needed for EVD placement would reduce the time between the decision to place an EVD and the procedure start time.

Materials and Methods: The NMICU UPP team designed a bag with all equipment needed for EVD placement. A system was developed where the bag was checked and restocked daily. Two neurosurgery residents performed time trials, measuring the time from the decision to place an EVD, to collecting the equipment from the NMICU and returning to the patient's bedside in the emergency department. Times were compared with and without using an EVD "Go Bag".

Results: Implementation of the EVD "Go Bag" reduced mean time to begin EVD placement from 17 min to 4 min ($p<10$ to 6).

Conclusion: The EVD "Go Bag" significantly decreases the time to placement of an EVD when compared to residents gathering EVD equipment. It should also both decrease nursing time required for material procurement and improve tracking of materials used.

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Introduction

The External Ventricular Drain (EVD) is commonly used to divert Cerebrospinal Fluid (CSF) away from the ventricles to manage increased Intracranial Pressure (ICP); it also functions as an ICP monitor [1]. The most urgent indication for EVD placement is acute obstructive hydrocephalus, frequent sequelae of intraventricular hemorrhage, which can quickly progress to brain herniation if not treated in a timely manner [2]. The expedient procurement of all components required for EVD placement is vital to preserve neurologic function. Though there are a variety of commercially available cranial access kits, these typically omit the EVD catheter, drainage system, and various ancillary supplies, such as sterile gowns and gloves, which are no less necessary to EVD placement. Previously, the practice at our institution was for the on-call neurosurgery resident to gather supplies from the Neuro-Medicine ICU (NMICU) supply room after the decision was made to place an EVD. EVD supplies were not stored in the Emergency Department (ED) due to lack of space. Working with the NMICU Unit-based Performance Program (UPP) team, which includes the ICU medical director, nursing leadership, and neurosurgery residents, we created an EVD "Go Bag" containing all the equipment necessary for EVD placement, with the goal of reducing the time between the decision to place an EVD and the procedure's start.

Materials and Methods

This project was undertaken as a quality improvement project. Two large duffel bags with shoulder straps were obtained, and labeled with the NMICU unit number; each of these bags was filled with two Bactiseal EVD catheters (Integra), a CSF collection system, a bottle of Betadine solution, a 500 mL bottle of sterile normal saline, an extra-large sterile gown, two pairs of size 7.5 sterile gloves, two bouffant caps, two surgical masks, an EVD transducer with associated monitor cable, sterile towels, Hypafix tape (3 M), and a cranial access kit (Integra). Additionally, a pencil case containing smaller supply items was placed in each duffel bag; these cases contained a marking pen with ruler, six packages of gauze sponges, two packages of cover sponges, a 2 to 0 silk suture, three 3 to 0 Prolene sutures, three 10 mL sterile saline flushes, three sterile caps, and a rechargeable

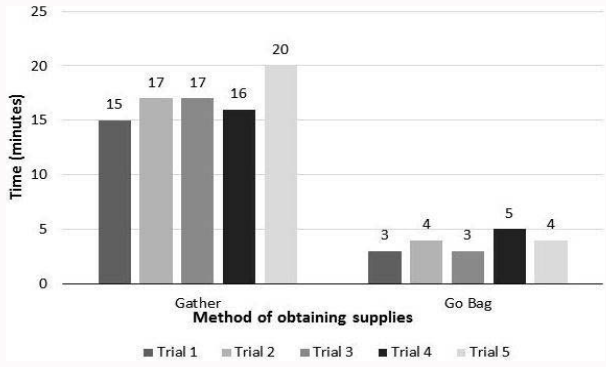

Figure 1: Five time trials for each method of procurement for EVD supplies.

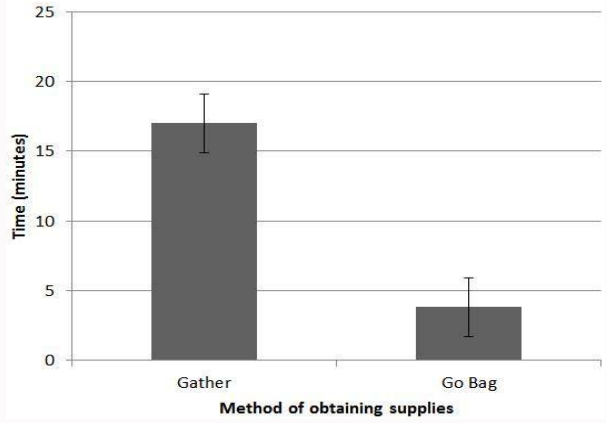

Figure 2: Average time to EVD procedure start with and without use of a "Go Bag". Error bars are 95% confidence intervals.

hair-clipper with two coarse and two fine blades. A laminated card with both of these lists of supplies was placed in the outside pocket of each duffel bag.

Once filled, the bags' zippers were secured with a tamper-evident plastic tie. Bags without intact ties were checked and restocked daily by both the critical care equipment technicians and the charge nurse of the NMICU, to ensure the bags were ready when needed. Following EVD placement, the bags were returned to the NMICU charge nurse for restocking.

Prior to creation of the EVD Go bag, two junior neurosurgery residents performed time trials, in real emergency situations, by measuring the time from the decision to place an EVD in the ED critical care bay, to collecting the equipment from the NMICU and returning to the patient's bedside. Measures were repeated by the same neurosurgery residents once the Go bag was implemented. A two-sample t test was used to compare times before and after the implementation of our EVD "Go Bag".

Results and Discussion

When supplies were gathered piecemeal from the NMICU supply room, the time between the decision to place an EVD in the critical bay and returning to bedside with all the needed equipment ranged from 15 min to 20 min, with a mean time of 17 min. After the implementation of the EVD "Go Bag", this interval was greatly reduced, and ranged from 3 min to 5 min, with a mean time of approximately 4 min (Figure 1). As hypothesized, a two-sample t test found the average times before and after EVD Go Bag implementation to be significantly different, with a $p<10$ to 6. The average difference in time between gathering supplies and using an EVD Go Bag was 13 min, with a 95% confidence interval ranging from 11 min to 15 min (Figure 2).

The EVD "Go Bag" decreases the time to placement of an EVD by a minimum of 10 min when compared to the previous practice of retrieving all EVD equipment from the NMICU stockroom. This substantial time reduction demonstrates the impact of eliminating the need to individually gather the supplies needed to perform an EVD. Additionally, since the EVD Go Bags' contents and location are standardized, a NMICU staff member can easily and quickly bring all the necessary supplies to the patient's beside while the on-call neurosurgery resident is either obtaining consent or preparing the patient for the procedure.

Implementation of the EVD "Go Bag" should also allow for better tracking of equipment utilization, since it is clear which bags have been used and which supplies need to be replaced. This would in turn facilitate stocking of supplies, cost monitoring, and billing; it should also reduce the amount of nursing time devoted to materials procurement.

The EVD "Go Bag" can be viewed alongside the trend toward greater standardization of equipment for invasive bedside procedures, including central and arterial lines. Given studies demonstrating reduced procedural errors and bloodstream infections after the introduction of pre-packaged, all-inclusive central line kits [3,4], it is reasonable to speculate that the EVD "Go Bag" may similarly facilitate good procedural technique by reducing cognitive load. Our institution's rate of EVD associated ventriculitis was <1% prior to Go-Bag introduction and remained <1% post-introduction, thus there was little room for improvement.

Conclusion

Our pilot study of the EVD "Go Bag" yielded statistically significant reductions in the lag time between the decision to place an EVD and the procedure's start. We believe this difference is also clinically significant, given the rapidity with which patients with increased intracranial pressure can decompensate. This project clearly demonstrates the value of a standardized, portable, all-inclusive EVD kit.

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