FLUID VOLUME MEASUREMENT
RELIABILITY OF COMMERCIALLY AVAILABLE DRAINAGE BAGS

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ABSTRACT... Objectives: (1) To measure the difference between the actual and observed volumes of fluids as measured by the commercially available drainage bags. (2) To find out reliability of fluid volume measurements as observed in commercially available drainage bags. **Settings:** Surgical Unit II, IIMCT Railway Hospital, Rawalpindi. **Study design:** Descriptive. **Materials & methods:** Commercially available drainage bags were used to observe the volume of fluid contained in it. The fluid (tap water) was introduced in the bag with a 50 cc syringe in 50 cc increments starting from 50 cc to 1050 cc. and the difference between observed volume and actual volumes were recorded. Data was analyzed with SPSS. **Results:** A total of twenty-one observations were made in 02 different commercially available urine bags. Major differences were found in the observed and measured volume with minimum difference of 50 -230 ml and maximum difference of 200-520ml. **Conclusions:** Significant differences were found between the actual volumes and the volumes observed by the marks on the drainage bags. It is noted that the observed value of the fluid volume contained in a drainage bag is highly unreliable and should not be used for clinical decision making.

Key words: Drainage bags, body fluids, reliability, clinical decision

INTRODUCTION

Measurement and monitoring of volumes of biological exudates, body fluids and drain outputs etc. is fundamental to clinical managements. Usually these measurements are made using the marks inscribed over commercially available appliances like drainage bags, suction bottles, and other similar appliances. The results of these measurements constitute the basis of clinical decisions of vital importance. It is imperative that these measurements are accurate, reliable, and dependable to provide the basis for correct and beneficial decision making. The present study examines the accuracy of such measurements and assesses the reliability of these measurements done by the use of commercially available disposable plastic drainage bags.

MATERIALS AND METHODS

The appliances used in the study were a 50 ml disposable syringe, a graduated cylinder with marks up to 500 ml (picture 1), and 2 commercially available plastic disposable drainage bags (picture 2 and 3) with marks up to 1500 ml. Tap water was filled in the 50 ml syringe and the volume added to the drainage bag in 50 ml increments. The measurements started from 50 ml and a volume up to 1050 ml was measured. The actual volumes introduced in the drainage bag and the volumes measured by the drainage bag were recorded separately. Standardization and confirmation of volume measurements was done using the graduated cylinder. Data was analyzed.

RESULTS

A total of twenty-one observations were made. (Table I) The observations started with actual volume of 50 ml and with increments of 50 ml. A total of 1050 ml actual volume was observed. Significant differences were found between the actual volume of fluid in the drainage bag and its observed volume. Maximum difference was 200 ml and minimum 50 ml with a mean of 140 ml.

These observations were repeated on another commercially available bag (Table II). Maximum difference found was 520ml and the minimum difference was 230ml with a mean of 443.33ml. In all observations made, the actual volume of fluid was less than the observed volume of fluid contained in the drainage bag. Statistical analysis was done using SPSS. The paired samples T test was applied and the results are shown in Table III.

DISCUSSION

This study examines the reliability of fluid volume measurements done by a disposable drainage bag. Many such appliances are widely used clinically for the purpose of measurements of fluid volumes[1]. No such studies have been done in the past to assess the

Table-I. Measurement of actual volume and observed volume in a commercially available drainage bag 1.

Actual volume 'A' (ml)	Observed volume 'O' (ml)	Difference 'A-O' (ml)
50	120	-70
100	170	-70
150	200	-50
200	250	-50
250	300	-50
300	400	-100
350	420	-70
400	500	-100
450	600	-150
500	650	-150
550	700	-150
600	800	-200
650	850	-200
700	900	-200
750	950	-200
800	1000	-200
850	1050	-200
900	1100	-200
950	1150	-200
1000	1180	-180
1050	1200	-150

Table-II. Measurement of actual volume and observed volume in a commercially available drainage Bag 2.

Actual volume 'A' (ml)	Observed volume 'O' (ml)	Difference 'A-O' (ml)
50	280	-230
100	400	-300
150	500	-350
200	600	-400
250	680	-430
300	730	-430
350	800	-450
400	870	-470
450	920	-470
500	990	-490
550	1040	-490
600	1090	-490
650	1170	-520
700	1200	-500
750	1250	-500
800	1300	-500
850	1320	-470
900	1380	-480
950	1440	-490
1000	1500	-500
1050	1600	-350

Table-III. Statistical analysis

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% confidence interval of the difference				
					Lower	Upper			
Pair 1	Actual observed	-452.857	76.625	16.721	-487.737	-417.978	-27.083	20	.000

reliability of such measurements and most of these appliances are used as standard measuring devices for the purpose of making such measurements. This study substantiates the high error margin in these observations and establishes the need to use standard measuring devices to make these observations reliable, valid and dependable for clinical decision-making.

It is important to note that these drainage bags are used to monitor urine output, and nasogastric output[2]. These bags are attached to peritoneal drains to monitor different abdominal exudates. As our study clearly indicates that these bags are highly unreliable for the measurement of this important measurement, which guides the course of clinical management, it is highly desirable that bags or containers with accurate measurements should be used for the measurements of these biological exudates.

REVIEW OF LITERATURE

The literature on the disparity between the observed volume and measured volume in commercially available plastic bags is almost non-existent. No study was found while searching for the literature on PubMed, Cochrane and Google search engines, except few patents[3] and newer methods[4] for the accurate measurement of biological exudates that can be attached to these bags were found. It is therefore required that extensive research be carried out in this respect and accurate measurement of biological exudates be done as they influence the clinical decision-making.

CONCLUSIONS

Measuring the fluid volume by the use of plastic disposable drainage bags is not a reliable way of measurement of fluid volume. The difference between the actual volume and the observed volume is never less than 50 ml and there is a variation in this difference at different volumes. Measurements done by drainage bag observations should not be used clinically for decision-making.

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"If everything seems under control, you're just not going fast enough."

(Mario Andretti)