CASE REPORT

SIMULATION EXERCISE USING CADAVERS TO TRAIN BONE MARROW ASPIRATION TECHNIQUE – SECOND YEAR UNDERGRADUATE MEDICAL STUDENT'S PERSPECTIVE

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ARTICLE INFO	ABSTRACT
	Simulation exercise using cadavers to train bone marrow aspiration technique – second year undergraduate medical student's perspective. **Introduction:** Simulation is "the imitation of the operation of a real-world process or system over time". The main goal is to significantly reduce the margin of error in real life situations. Cadaver had been used to train psychomotor skills for medical students. We attempted to find out the students perspective of bone marrow aspiration training by simulation technique using cadavers to second year undergraduate medical students while teaching hematology. **Methods:** 127 students from second year MBBS with four faculties participated in this study. The students were divided into groups and facilitated by a faculty. Bone marrow aspiration was done in cadavers from Anatomy department. A survey was taken through feedback. **Results:** All the students appreciated the facilitator for their encouragement, interaction and preparations (99.9%). 82.65% of the students appreciated the clarity, relevance and usefulness of the skills learned and 63.17% of the students felt the organization, facilities and atmosphere was good for learning. **Discussion:** Various studies in the past corroborated with our study results. Newer and better methods of embalming like Thiel embalming has emerged which makes the cadaver more real life-like. In developing countries like India, cadaver can be an economic alternative to other methods.

INTRODUCTION

Simulation is "the imitation of the operation of a real-world process or system over time" (Simulation, Wikipedia, 2015). It is the artificial representation of a complex real-world process with sufficient fidelity with the aim to facilitate learning through immersion, reflection, feedback, and practice minus the risks inherent in a similar real-life experience (Ogden PE *et al.*, 2007). The main goal of simulation is to significantly reduce the margin of error in real life situations such as highway or hospital emergency room (National Highway Traffic Safety Administration NHTSA. The National Advanced Driving Simulator NADS, 2015), (Sood R, Adkoli 2000). Simulation can beof particularly usefulin improving the psychomotor domain of the individual learner, the multidisciplinary team, and the hospital as a whole. David M Gaba, one of the pioneers in simulation, points out that simulation is only a technique not a technology. He categorized simulation in health care by 11dimensions.

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He urged the health care community to ensure that simulation should be made part of medical training in the forthcoming future (Gaba, 2004). Similar views were expressed by other authors that the medical education is under pressure from political, clinical and financial pressures and simulation is the answer for all these challenges which includes cadaveric training (Akhtar *et al.*, 2014). Dr.VictorDiniz de Pochat, a plastic surgeon has analyzed the performance of the residents for a period of two years in Plastic Surgery Service of Hospital Universitario Professor Edgard Santos, Bahia, Brazil. He observed that the residents developed considerable gains in skills by developing activities related to cadaver dissection (Victor Diniz de Pochat *et al.*, 2011). Also cadaver had been used as a tool in other areas of skill development in medical education like laparoscopy, ureteroscopy, central venous line insertion (Edelman *et al.*, 2012), (Ogan *et al.*, 2004), (Martin *et al.*, 2003). Predominantly psychomotor skill like bone marrow aspiration is usually learned in the hard way of trial and error at the cost of patient suffering. So we tried simulation technique using cadavers from the anatomy department, to teach the skill of bone marrow aspiration to second year

undergraduate medical students. Thus we wanted to know the students perspective of cadaveric bone marrow aspiration training while teaching hematology.

MATERIALS AND METHODS

127 students participated in this study from second year MBBS. Four faculties participated in the sessions which included three Assistant Professors and 1 Professor from the Department of Pathology. Initially the faculties, under the supervision of the professor, did bone marrow aspiration to get used in handling the cadavers. 127 students were divided into two batches. Each batch was then divided into 4 groups comprising of 15-16 students each. The session was conducted for 2 days, one day for each batch. Each group was facilitated by a faculty. At the beginning of the session, one student volunteer from each group briefed about what they were going to do. The site of aspiration chosen was the posterior superior iliac spine and the instrument used was Salah's bone marrow aspiration needle. The facilitator used a pelvic bone to anatomically locate the land mark of posterior superior iliac crest. (Figure 1) This is followed by the bone marrow aspiration procedure with the cadaver lying prone. On one side of the cadaver the skin flap was open and the muscles were reflected with the bone exposed. On the other side the skin was intact. All the students were given a chance to perform the procedure and many attempts were encouraged till they felt confident. (Figure 2) Voluntary, anonymous survey was taken through feedback, using a pre-validated questionnaire, formulated with a five point Likert scale about the session.

Figure 1. Facilitator showing posterior superior iliac crest in pelvic bone

Figure 2. Students practicing the bone marrow aspiration procedure

The questions were set about three categories; 1. Clarity, relevance, usefulness of the procedure, 2. Organization, facilities, time, learning atmosphere and 3. Role of the facilitator.

Table 1. Student feedback results

		Strongly agree 5	Agree 4	Neutral 3	Disagree 2	Strongly disagree 1
1.	Objectives of the training were clearly defined.	24(22.4%)	70(65.4%)	13(12.1%)	-	-
2	The skills taught were relevant to me.	32(29.9%)	55(51.4%)	20(18.6%)	-	-
3	The skills taught will be useful to do bone marrow aspiration in real patients.	47(43.9%)	60(56.0%)	-	-	-
4	The training objectives where met.	6(5.6%)	60(56%)	41(38.3%)	-	-
5	Session was organized in a learner friendly manner.	50(46.7%)	55(51.4%)	2(1.8%)	-	-
6	The time allotted was sufficient.	24(22.4%)	20(18.6%)	61(57%)	2(1.86%)	-
7	The learning facilities were adequate and comfortable.	12(11.21%)	42(39.2%)	45(42%)	8(7.4%)	-
8	Participations and interactions were encouraged by the facilitator	43(40.1%)	64(59.8%)	-	-	-
9	The teacher had sufficient knowledge about the procedure.	73(68.2%)	34(31.7%)	-	-	-
10	The teacher was well prepared.	53(49.5%)	54(50.4%)	-	-	-

Table 2. Likert scale analysis of results

Category 1.	Clarity, relevance, usefulness of the procedure (Rows 1 to 4). (Minimum score 4 & maximum score 20)	
	Students	Score
	25.45%	20 (Strongly agree)
	57.2%	16 (Agree)
Total	82.65%	
Category 2.	Organization, facilities, time, learning atmosphere (Rows 5 to 7). (Minimum score 3 & maximum score 15)	
	Students	Score
	26.77%	15 (Strongly agree)
	36.4%	12 (Agree)
Total	63.17%	
Category 3.	Role of the facilitator (Rows 8 to 10) (Minimum score 3 & maximum score 15)	
	Students	Score
	52.6%	15 (Strongly agree)
	47.3%	12 (Agree)
Total	99.9%	

RESULTS

All the participants gave feedback and the results were tabulated (Table 1) and analysed by the three categories (Table 2). 82.65% of the students appreciated (Agree or Strongly Agree) the clarity, relevance and usefulness of the skills learned and 63.17% of the students felt the organization, facilities and atmosphere was good for learning (Agree or Strongly Agree).

All the students appreciated the facilitator for their encouragement, interaction and preparations (99.9% Agree or Strongly Agree).

DISCUSSION

The results of our study clearly points that the undergraduate students appreciated and benefitted from the sessions of cadaver training on various aspects. Various studies in the past corroborated with our study results. Edelman *et al.*, from the Surgery department of Wayne State University, Detroit, Michigan, USA, studied the effect of cadaver dissections along with other methods in developing the skills of Fundamentals of Laparoscopic Surgery (FLS) in fourth year undergraduate students. When the students were assessed later they showed statistically significant increased skill levels in FLS, almost equivalent to the surgical residents. He supports integration of this kind of training in undergraduate curriculum (Edelman *et al.*, 2012). In 2012 Lewis *et al.*, in David Geffen School of Medicine, University of California, Los Angeles, USA conducted a survey among General surgery residents. They were trained for surgical skills using various modalities like fresh frozen cadavers, text books, simulators, websites, animate laboratories and lectures. Highest percentage of students have agreed or strongly agreed that cadaver training was useful in learning anatomy, learning the steps of operation and increased confidence in doing the procedure. They also agreed or strongly agreed that they wanted more sessions and given a chance, would have spent more time in the cadaver laboratory (Lewis *et al.*, 2012). Anastakis *et al.*, a medical education research team from the University of Toronto, Ontario, Canada, studied 23 first year residents in training six procedures. The residents were divided in to three groups; one on a cadaver model, another one on a bench model and the third one from a prepared text model. Statistical analysis of checklist and global scores of the groups revealed both bench and cadaver training were superior to text learning (Anastakis *et al.*, 1999). Martin *et al.*, form Centre hospitalieruniversitaire de Sherbrooke, Fleurimont, Quebec, Canadaintroduced a training program for fourth year undergraduate students in Central Venous Line Insertion (CVLI) using cadavers. Then they assessed their skills compared to the students who did not receive this training. This is by accounting the number Pneumothorax (PTX) developed during CVLI. There was a statistically significant reduction in PTX in patients by the batch which has received the cadaveric training (Martin *et al.*, 2003).

Some authors have used cadaver as an assessment tool for various procedures like testing the proficiency of ureteroscopy (Ogan *et al.*, 2004) and analyzing the outcomes of various orientation of the patient during bone marrow biopsy (Konda, 2014). Due to the various advantages of cadaveric training some new methods of embalming techniques have emerged like Thiel method. Healy *et al.*, from Nine wells Hospital and Medical School, University of Dundee, Dundee, Scotland, United Kingdom in a review article, emphasized the use of Thiel embalmed cadavers in urologic training and commented on the tissue quality, elasticity and handling in these cadavers (Healy *et al.*, 2015). Another group of authors Eisma *et al.*, from the same Dundee University concurs with the superiority of Thiel embalming in a study in thyroid surgery training (Eisma *et al.*, 2011). The uses of fresh frozen cadavers were also tested in training procedural skills (Ocel *et al.*, 2006) and their efficacy was assessed using construct validity in minimal access surgery (Sharma *et al.*, 2012). However some authors have expressed their reservations over using newly and nearly dead patients from ethical point of view (Berger *et al.*, 2002).

There were few disadvantages. The students could not get a real life experience as they are not connected with the patients. They do not feel the pain and emotions of the patients and miss the affective domain of the learning process. Eisenstein *et al.*, from Boston University School of Medicine, Boston, Massachusetts, USA, had developed a novel Cadaver Biopsy Project (CBP), which will be used for vertical integration in undergraduate students. The biopsies taken from cadaver in first year will be used to correlate and integrate subjects like Histology, Pathology, and Radiology etc. (Eisenstein *et al.*, 2014).

In developing countries like India, simulation labs have not been implemented on a large scale because of the high cost involved. In this context cadavers are a good alternative. Other clinical skills such as endotracheal intubation, lumbar puncture, intramuscular injections and suturing also can be taught effectively.

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