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Drug utilization study in a burn care unit of a tertiary care hospital

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ABSTRACT

Objective: To evaluate drug utilization and associated costs for the treatment of patients admitted in burn care unit of a tertiary care hospital. **Methods:** A prospective cross sectional study was conducted for a period of 15 months at Basaweshwara Teaching and General Hospital (BTGH), Gulbarga and the data collected was analyzed for various drug use indicators. **Results:** A total of 100 prescriptions were collected with 44% belonging to males and 56% to females. The average number of drugs per prescription ranged from 4.5 to 9.5. 9.5% of generics and 92% of essential drugs were prescribed. The opioid analgesics and sedatives were prescribed to all the patients who were admitted in burn care unit. The (Defined daily dose) DDD/1 000/day for amikacin (359) was the highest followed by diclofenac sodium (156), pantoprazole (144), diazepam (130), ceftazidime (124), tramadol (115), ceftriaxone (84) and for paracetamol (4) which was the lowest. **Conclusions:** Significant amount of the money was spent on procurement of drugs. Most of the money was spent on prescribed antibiotics. The prescription of generic drugs should be promoted, for cost effective treatment. Hence the results of the present study indicate that there is a considerable scope for improvement in the prescription pattern.

1. Introduction

Drug utilization studies are particularly interesting if they are focused on the most frequently used group of therapeutic drugs, such as antibiotics, NSAIDs or those that constitute important therapeutic innovation. Drug utilization is defined as "the marketing, distribution, prescription and use of the drugs in a society, with special emphasis on the resulting medical, social and economic considerations[1]. Several studies have demonstrated that the prescribing of drugs may be unsatisfactory. These studies can be helpful in highlighting and assessing the prevalence and the importance of such lacunae and in suggesting remedial measures[2]. The drug utilization 90% (DU 90%) index was introduced as a simple, inexpensive and flexible method for assessing the quality of the drug prescriptions. It identifies the drugs accounting for 90% of the volume of the prescribed drugs after ranking the drug used by volume of defined daily dose (DDD)[3]. The remaining 10% may contain specific drugs which are used for rare conditions in patients with a history of drug intolerance or adverse effects[4]. The Swedish medical quality council has recommended the DU 90% method for assessing the general quality of drug prescribing. The DU 90% has been established as a reliable cut off level for pharmacoepidemiology and economic surveys and can be considered for the elaboration of a "health cost index"[5].

Burn is a tissue injury from thermal (heat or cold) application or from the absorption of physical energy or chemical contact. Injury is the commonest cause of death among people who are aged between 1 to 34 years and is a leading cause of disability. It is a major contributor to the health costs[6]. The National Academy of Science in the United States has labelled injury as the "Neglected Disease of Modern Society"[7]. The term injury by definition means that there is a body lesion due to an external cause, which is intentional or unintentional, resulting from a sudden exposure to the energy generated by agent host interaction, leading to tissue damage, when it exceeds the physiological

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tolerance of the individual[8]. An estimated 184 000 persons died of burn injuries in the countries of SERA in 2002, with 6.55 million DALYs lost due to burn[9]. India recorded 19 278 deaths due to burns during the year 2003[10].

Burn injury results in a lot of systemic changes, among which the most significant is alteration in fluid and electrolyte balance. Edema formation in burnt and un-burnt tissue occurs due to gross fluid shift and this ultimately leads to shock in burns patients. Hence it is critical to understand that fluid replacement therapy is instituted immediately at the appropriate time[11]. The majority of the survivors with moderate and severe grades of injury, experience a lifelong psychological impact and a poor quality of life[12].

Drug utilization studies are powerful tools to ascertain the role of drugs in the society[13]. They provide a sound socio-medical and health economic basis for health care decision making. To achieve this, it is very important to determine the drug use pattern and to monitor the drug use profiles using the Anatomic Therapeutic Chemical Classification (ATC)/Defined Daily Dosage (DDD) system as a tool for drug utilization in order to improve the quality of drug use. The WHO specifies drug use indicators for adoptions in the drug utilization studies. There is a paucity of such studies on the international level and these are nonexistent at our national and regional level in the area of burns. In this study, We also investigated the perspective of the patients such as diagnosis, age, sex, previous drug history, admission to hospital and cause of death, if he dies then extented to which drugs are used and misused in the burn unit[14] .

The present study was designed: a) To evaluate the prevailing prescription trends in the burn care unit and; b) To know whether the prevailing prescription pattern will have any impact of economic burden on the patients in order to improve the quality of medical care.

2. Material and methods

This prospective cross-sectional study was conducted for 15 months *i.e.* from Oct. 2002 to Dec. 2003 at burns care unit (BTGH), attached to MR Medical College, Gulbarga. The patients were recruited after obtaining their informed consent. The study protocol was approved by the Institutional Ethics Committee of MR Medical College, Gulbarga. 100 prescriptions from the newly registered patients were included in the study with a written proforma. The patients were diagnosed and the clinical signs and symptoms of the burns were documented. The estimation of extent of burns was done by rule of nine (After Wallace) which describes the percentage of body surface area represented by various anatomical areas such as, each upper limb 9%, each lower limb 18%, anterior and posterior trunk each 18%, head and neck 9% and perineum genitalia 1%[15]. This rule does not apply strictly to infant and children. In a child of one year age, the head and neck area is 18% and each leg is 14%. In this drug utilization study, demographic characteristics such as age, sex and diagnosis were recorded. All the patients who were admitted in the burn care unit received drugs through parenteral and transdermal route and 84% of patients through oral route. We also studied the NSAID utilization that accounted for 90% of the use (drug utilization 90%) in order to determine the quality of prescribing[16]. Once the consultation by the surgeon was over, the prescriptions were copied and the patients were interviewed as per the WHO guidelines. The following WHO drug use indicators were determined[17].

2.1. Core indicators

2.1.1. Prescribing indicators

a) The average number of drugs per encounter was calculated by dividing the total number of different drug products prescribed of encounters surveyed. b) The percentage of drugs prescribed by the generic name was determined by dividing the number of the generic drugs prescribed by the total number of drugs prescribed, multiplied by 100. c) The percentage of encounters with an antibiotic which was prescribed. d) The percentage of encounters with an injection which was prescribed were calculated by dividing the number of patient encounters during which an antibiotic or an injection was prescribed by the total number of encounters surveyed, multiplied by 100. e) The percentage of drugs prescribed from the essential drug list was determined by dividing the number of products from the essential drug list of the hospital by the total number of drugs prescribed, multiplied by 100.

2.1.2. Patient care indicators

a) The average consultation time was determined by dividing the total time for a series of consultations, by the actual number of consultations. b) The average dispensing time was calculated by dividing the total time for dispensing drugs to a series of patients, by the number of encounters. c) The percentage of drugs which were actually dispensed was worked out by dividing the number of drugs which were actually dispensed at the health facility by the total number of drugs prescribed multiplied by 100. d) The patient's knowledge of correct dosage was found by dividing the number of patients, who could adequately report the dosage schedule for all drugs, by the total number of patients who were interviewed, multiplied by 100.

2.1.3. Facility indicators

a) The availability of the copy of the essential drug list: By stating yes / no regarding to the availability of "key drugs" was calculated by dividing the number of the specified products which were actually in stock by the total number of drugs on the check list of the essential drugs multiplied by 100.

2.1.4. Complimentary indicators

a) The percentage of patients treated without drugs was calculated by dividing the number of consultations in which no drug was prescribed by the number of consultations surveyed. b) The average drug cost per encounter was determined by dividing the total cost of all drugs which were prescribed by the number of encounters surveyed. c) The percentage of drug costs which were spent on injections was determined by dividing the cost of the injections which were prescribed by the total drug cost.

2.2. ATC/DDD System

We used the Anatomic Therapeutic Chemical Classification (ATC) for the calculation of the defined daily dose (DDD) and the DU 90% methodology to determine NSAID use. In the ATC classification system, the drugs are divided into different groups according to the organ or the system on which they act and their chemical, pharmacological and therapeutic groups at five levels. DDD is the estimated average maintenance dose per day of a drug when used in its major indication. DDD is established on the basis of assumed average drug use per day in adults and provides a rough estimate of the drug consumption. DU 90% is the number of drugs which are responsible for 90% of the prescriptions. It has been proposed as a single method for assessing the general quality of drug prescribing[18]. The principle of the DU 90% method is to focus on the bulk of prescribing (or use).

DDD /1000/ Day:

$$\text{DDD /1000 /Day} = \frac{\text{Total number of dosage unit prescribed} \times \text{Strength of each Dosage unit} \times 1000}{\text{DDD} \times \text{Duration of study} \times \text{Total sample size}}$$

DDD was calculated as per the guidelines for ATC classification and DDD assignment (January 2010) as given by the WHO Collaborating Center for Drug Statistics Methodology. Oslo, Norway[19].

2.3. Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 11.0 (Inc. USA, 2005) was used for data analysis. The comparison of different variables in various groups was done by using the student's test for all the tests, a probability (p) value of less than 0.05 was considered to be significant.

3. Results

A total of 100 prescriptions were collected with 44% belonging to males and 56% to females. There were 54% patients aged 1–25 yrs, 36% patients aged 26–50 yrs, 8% patients aged 51–75 yrs and 2% patients aged > 75 yrs. The average duration of stay in the hospital (days) was 1–5days for 48% patients, 6–10 days for 30% patients, 11–15 days for 12% patients and > 15 days for 10% patients. Out of 100 cases 90% were accidental and 10% were suicidal. 82% of cases were diagnosed as burn, 12% cases as electric shock and 6% cases as scalds. 10% of cases had 1%–10% of burns, 10% of cases had 11%–20% of burn, 8% of cases had 21%–30% of burn, 12% cases had 31%–40% of burns, 8% of cases had 41%–50% of burns, 14% of cases had 51%–60% of burns, 6% of cases had 61%–70% of burns, 8% of cases had 71%–80% of burns, 8% of cases had 71%–80% of burns, 8% of cases had 81%–90% of burns and 16% of cases had 91%–100% of burns. 44% of cases were discharged on advise, 36% of cases expired during treatement, 16% of cases discharged against medical advise and 4% of cases were referred to higher center. 20% of cases reported gastritis, 12% of vomiting, 10% super infection (Diarrhea) and 8% of cases had allergic reaction as an adverse effects of drugs. The drug use indicators are shown in Table 1–4. The drugs used in the burn care unit with DDD/1000/day is shown in Table 5.

Table 1

Prescribing indicators	Data
Average drugs prescribed	4.5–9.5
Not mentioned in prescription %	
a) Superscription	2.5
b) Age	Nil
c)Diagnosis	Nil
Generic drugs	9.5%
Prescription of (%)	
a) NSAID	100%
b) Anti microbial	100%
Duration of antimicrobial treatment (days)	9.5
Duration not mentioned (%)	1.8
c)Antiulcer drugs	96%
d)I.V. fluids	100%
e)Injection	100%
f)On essential drug list	92%

Table 2

Patient care indicators	Data
Average consultation time in(min)	10.35
Average dispensing time in (sec)	12.85
Drug dispensed	95%
Adequate knowledge	51.26%

Table 3

Facility indicators	Data
Availability of essential drugs list	Yes
Key drugs available	91 %

Table 4

Complimentary indicators	Data
Without drugs with "meal plan"	00 %
Average drugs cost (Rs)/ prescription	Rs.1650/–
Drug cost on injection	Rs. 850/–

Table 5
Utilization of drugs expressed as number of prescription and defined daily dosages (DDDs) for a period of five days, DU 90% (NSAID) the number of drugs that account for 90% of drug use.

DRUGS	SL.NO	Drug (Route of administration)	ATC Code	DDD	Prescriptions (%)	DDD /1000 /Day
NSAIDS	1	Diclofenac (P)	MO1AB05	0.10 g	52	156
SEDATIVES	2	Nimesulide (O)	MO1AX17	0.20 g	6	12
	3	Diclofenac+Paracetamol (O)	MO1AB55	0.10 g	8	–
	4	Rofecoxib (O)	M01AH02	0.25 g	4	16
	5	Paracetamol (O)	MO2BEO1	3.00 g	4	4
		Serratiopeptidase (O)	MO1AB55	0.10 g	62	25
	1	Diazepam (P)	N05BA01	10.00 mg	65	130
	2	Fludiazepam (O)	N05BA17	0.70 mg	10	27
	3	Chlordiazepoxide (O)	N05BA02	30.00 mg	10	50
	4	Alprazolam (O)	N05BA12	1.00 mg	15	45
	7	Tramadol (P)	N02AX02	0.30 g	86	115
OPIOIDS	8	Pentazocin (P)	N02AD01	0.20 g	28	17
	9	Buprenorphine (P)	N02AE01	1.20 mg	4	4
	10	Tramadol (O)	NO2AX02	0.30 g	4	3
DU 90% OF DRUGS 1–5						
ANTIBIOTICS	9	Amikacin (P)	JO1GB03	0.24 g	86	359
	10	Ceftazidime (P)	JO1DD09	2 g	62	124
	11	Ceftriaxone (P)	JO1DD04	2 g	42	84
	12	Cefoperazone+Sulbactum (P)	JO1DD62	4 g	18	18
	13	Cefotaxim (P)	JO1DD01	4 g	14	14
	14	Cefixime (0)	JO1DD08	0.4 g	10	20
	15	Linezolid (P)	J01XX08	1.2 g	8	16
	16	Gentamycin (P)	JO1GBO3	0.24 g	6	8
	17	Ciprofloxacin (P)	JO1MA02	1g	4	8
ANTI–ULCER DRUGS	18	Pantoprazole (P)	A02BCO2	40 mg	72	144
	19	Ranitidine (P)	A02BA02	0.3 g	30	40
	20	Aluminum hydroxide (O)	A02AB01	0.6 g/10mL	64	–
I.V–.FLUIDS	21	Ringer lactate (P)	BO5BB	–	90	–
&	22	Dextrose 5% (P)	BO5BB	–	60	–
Nutritional supplements	23	Dextrose normal saline (P)	BO5BB	–	18	–
	24	Normal saline (P)	BO5BB	–	12	–
	25	10% Fructodex (P)	BO5BB	–	10	–
	26	Isolate–P (P)	BO5BB	6	6	–
	27	Oral rehydration solutions (O)		–	60	–
	28	Protein powder (O)		–	14	–
	29	Amino acid (P)	BO5BA01	–	12	–
	30	Multivitamin infusion (P)	A11A	20 mg	38	–
	31	Calcium gluconate 10% (P)	A12AA03	3 g	4	2
	32	Vitamin C (P)	A11GA01	0.2 g	4	–
	33	Vitamin K (P)	BO2BA01	20 mg	6	–
	34	Plasma expander (P)	BO5BA02	–	4	–
	35	Whole blood (P)		–	4	–
For intravenous fluids and nutritional supplements, DDD was not given because of greater variation in the dosage given to individual patients (Cases).						
Immunization Drugs	36	Tetanus toxoid (P)	J07AM01	0.5 mL	96	–
	37	Human tetanus immunoglobulin (P)	J06BB02	–	74	–
Topical & Transdermal route	38	1% Silver sulphadiazine	D06BA01	–	100	–
	39	Ciprofloxacin 0.3% eye drops	S03AA07	–	18	–
	40	Ciprofloxacin 0.3% eye ointment	S03AA07	–	6	–

ALPRAZOLAM ATC CODE: N05BA12. N–Nervous system, N05–Psycholeptics, N05B–Anxiolytics, N05BA–Benzodiazepine derivate. –: not available.

4. Discussion

The management of burn injury still poses a serious challenge. Burn care centers where ever they are available, have reduced the menace of the injury. The average number of drugs per prescription is an important index of the prescription audit. In the present study, the average number of drugs per prescription at the time of admission in the burn care unit was 4.5 and it increased to 9.5, when compared to the previous records of 3.03[20] and 4.07 [21] from various specialty hospitals in India and 2.9[22] from Hong Kong. The higher number of prescriptions made probably reflect the fact that 82% of the cases were of burn injury and therefore the ranges of the drugs prescribed could be high. In our study, injury was seen more in the female patients compared to the male patients, which can be compared to previous records by the NCRB reports in India[23]. The percentage of the generic drugs (9.5%) used was low and the drugs used from the essential drug list were higher (92%), when compared to those from two specialty hospitals in Delhi[21]. Out of the 100 prescriptions which were screened, among NSAID, diclofenac sodium (52%) was the most commonly prescribed drug, followed by diclofenac sodium +paracetamol, nimesulide, rofecoxib and paracetamol. Paracetamol (4%) was the only drug which was prescribed in the generic form. Two out of five NSAID, were found in the DU 90% segment. Sir William Osler called Morphine "God's own medicine". Opioids are the mainstay of pain treatment. In our study tramadol was the most commonly prescribed opioid analgesic followed by pentazocin, buprenorphine.

Routinely all the burn patients should be immunized with tetanus toxoid and human tetanus immunoglobulin. But in the present study, it was found that 4% of the cases had not received tetanus toxoid and that 26% of the cases had not received human tetanus immunoglobulin. It was observed that 36% of the cases expired and their burn percentage was between 61%-100% and most of the patients died during the first 24 hours of the admission. It could be due to delay in bringing the patients to the hospital, severe infection of burn wound and could be due to exposure of carbon monoxide inhalation and dehydration. In our study 44% of the cases were discharged on advice, 36% of cases expired during treatment, 4% of the cases were refereed to higher center and 16% of the cases were discharged against medical advice. Our study demonstrates that we have a high rate of deaths relative to norms established by the Major Trauma Outcome Society (MTOS)[24]. One of the reasons for this difference may be the lack of resources. Although our center is the major burn care center referral hospital in the region, the burn care provided to patients needs to be improved.

A prospective antibiotic utilization survey performed in 2 different medical departments showed that 35.3% and 39% of the admitted patients had exposure to at least one antimicrobial[25]. More than 50% of the average expenditure per patient's accounts was because of the antibiotics. The injection costs (100%) of the total expenditure showed that their inclusion in the prescriptions led to a higher cost, which was inevitable in the burn patients[26]. This was also confirmed by the high DDD of amikacin (359), followed by diclofenac sodium (156), pantoprazole (144), diazepam (130), ceftazidime (124) and for tramadol (115). For drugs like intravenous fluids and oxygen, no DDD have been assigned because the amount given per day can be varying very much according to the intensity and distribution of the diseases. The DDD was also not assigned for the immunization and topical preparations, consumption of figures of these preparations can be expressed in grams of preparation regardless of strength. The main purpose of the DDD system was to provide a tool for presenting drug utilization studies which would allow the measurement of drug consumption across the therapeutic group. The DU 90% methodologies (combined by ATC/DDD) have not been widely used as tools for measuring the qualitative and quantitative drug consumption in India.

Lofts in his study noted an expenditure of $ 647 per patients per day or $ 927 per % burn for the total cost of a successful inpatient management of major burn[25]. Burn care is expensive to procure and more so in the developed or developing countries where the average daily income per person in India is lowest in the world. According to recent statistics, the per capita income in India (2006-2007) is $731.53 (Rs. 33, 131) at current prices[26] and health insurance scheme was almost non-existent until recently. There is a need to look inward into the ways of making the cost of care less expensive for the patients. To the best of our knowledge drug procurement is one that is less expensive in the management of burn. More expenditure done on dressing, admission, nursing charges, surgical procedures and other miscellaneous expenses. The drugs especially antibiotics is also thought to be administered only when needed. Most of money was spent on prescribed antibiotics. Even though the use of antibiotics in burn management is controversial[27]. This excludes indirect cost to the patients on transportation, feeding as well as cost of disabilities and work days lost. Despite this fact, our study showed that it was a simple, inexpensive, rational, understandable and easy to use system. It provides the information on drug usage in patients and could be applied as a basis for prescription guidelines. A drawback of this study is that the time of evaluation after the injury was not uniform and many patients had received some treatment before admission. This is because our hospital is a tertiary referral center.

It may be concluded that, the drugs used in the burn care unit are in adherence with the standard treatment guidelines[28]. The incidence of poly pharmacy is very high, the generic is low and the essential drug prescription is high. The newer antimicrobials and the opioid analgesics are prescribed more often[29,30]. The prescription by generics

should be promoted more for cost effective treatement. The results of this study indicates that there is a considerable scope for improving the prescribing habits according to rational drug use and to provide a feed back to the hospital authorities [31,32].

Conflict of interest statement

We declare that we have no conflict of interest.

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