Prevalence, Risk Factors, and Management of Pressure Sores in the Teaching Hospital – Medical and Surgical Treatment

Mohit Kumar Mathur¹, Jagdish Mutreja¹, Nishant Singh Gill², KC Vyas³, Ashutosh Niranjana⁴, Ravi Kale⁵

¹Assistant Professor, Department of Surgery, School of Medical Sciences & Research, Greater Noida, ²Private practitioner, ³Professor & Head, Pacific Medical college & Hospital, Udaipur, ⁴Professor & Head, Department of Surgery, School of Medical Sciences & Research, Greater Noida, ⁵Professor, Department of Surgery, School of Medical Sciences & Research, Greater Noida

Abstract

Pressure ulcer have a profound impact upon the subjects lives, including physical, social and financial status, change of body image and loss of independence and control. The incidence of pressure sore formation is highly variable, depending on the population of patients evaluated. Pressure sores continues to affect the practice of every medical and surgical professional are common cases of morbidity in hospitalized persons. They lead to inconvenience to the patient and the treating doctor and it's still challenging for surgeon to treat and is a cause of mortality. Thus it requires multidisciplinary approach for its management. The preventive measures need to be constantly evaluated & updated; hence this study was carried out to analyze current status of pressure sores, their prevalence, risk factors and management (Medical v/s Surgical) & outcome ,

Key words: Pressure ulcers, Bed sores, Decubitus ulcers, Pressure sores, Pressure injury

Introduction

Pressure sores have defied the best attempts of medical & nursing staff since they were first described in Egyptian mummies. Dorland's Medical Dictionary describes an Ulcer (Latin, *ulcus*, Greek *heliosis*) as "a local defect or excavation on the surface of an organ or tissue which is produced by sloughing of inflammatory necrotic tissue". Pressure ulcer which develop primarily from pressure, friction & shear, are also known as decubitus ulcer, bed sore or pressure sore". The term decubitus comes from the Latin word *decumbere*, which means to "to lie down"¹

Pressure ulcer have a profound impact upon the subjects lives, including physical, social and financial status, change of body image and / or loss of independence and control. Despite countless advances in the last decade to enhance patient care, the treatment of pressure sores remains a significant challenge to the medical community. Pressure sores result from a complex process of tissue destruction. As with many multifaceted disease processes, a multidisciplinary approach to treatment is required. The team includes physicians from multiple fields (plastic surgery, general surgery, orthopedic surgery, internal medicine, endocrinology, and neurology) as well as nurses, nutritionists, and mental health experts.²

Corresponding author:

Dr. Jagdish Mutreja,

Assistant Professor,

E-Mail: jagdishmutreja81@gmail.com

The incidence of pressure sore formation is highly variable, depending on the population of patients evaluated. The incidence in hospitalized

patients ranges from 2.7% to 29% (prevalence by 3.5% to 69%). Patient in critical care unit run a higher risk of developing pressure ulcer, as evidenced by 33% incidence and 41% prevalence. In nursing home environment the prevalence of pressure ulcers ranges from 2.6% to 24%. The incidence in chronic care hospital is reported to be at 10.8%. The cervical region was found to have, the highest prevalence of pressure sores at single and multiple sites. The complete lesion and quadriplegic have a higher prevalence of pressure sore than incomplete lesion and a paraplegic.³

If pressure ulcer is infected, it may leads to local Abscess formation cause, osteomyelitis and leads to bacteremia and septicemia, and it may change into marjolin's ulcer.⁴ So treatment should be started as early as possible. The first step in treatment of pressure ulcer after removing pressure is elimination of necrotic tissue. Debridement may be surgical, mechanical, osmotic, chemical, enzymatic, autolytic. After debridement, different modalities of the wound dressing can be used.⁵

Despite the awareness of risk factors and preventive measures, complications from pressure sores during hospitalization remain frequent. It is in this context that the preventive measures need to be constantly evaluated & updated; a study was carried out to analyze current status of pressure sores, their prevalence, risk factors and management (Medical v/s Surgical) & outcome in RNT Medical College, Udaipur, Rajasthan.

Methodology

A prospective study conducted at RNT Medical College & MB Govt. Hospital, Udaipur, in all surgical & medical wards. Both males & females who were at high risk (Braden scale; 1987) of⁶ developing bed sores were selected from the out patient department of MB Govt. Hospital, Udaipur in one year duration 835 Patients were selected with grade I, II, III & IV

pressure ulcer according to NPUAP.⁷ If patient had multiple ulcers then each ulcer was taken as a single entity. Depending upon the scores grading is done and according to Braden Scale patients who score ≤ 12 are at high risk and are included in my study group.⁶

The inclusion criteria for my study group was High risk individuals depending upon Braden Scale, who score ≤ 12 , were patients with:

1. Spinal injuries (quadriplegics & paraplegics)
2. Femur or pelvic fractures
3. Septicemia with / without multi organ failure
4. Cerebrovascular accidents
5. Encephalopathy
6. Snake bite
7. Guillianbarresyndrom
8. Hanging
9. General patient who hospitalized more than 15 days.

The aim of the study was to evaluate the risk factors for pressure sores, which had been divided into local risk factors, systemic risk factor or disease related and hospital related risk factors.

1. Local risk factors:

- ☐ Pressure
- ☐ Shearing force
- ☐ Friction
- ☐ Capillary occlusion & disruption of lymphatic drainage
- ☐ Increased temperature & moisture

2. Systemic risk factors or disease related:

- ☐ Patients age
- ☐ Mental status
- ☐ Anemia
- ☐ Malnutrition e.g., serum albumin <3.5gm/dl.
- ☐ Moisture problems e.g., perspiration, wound drainage, bowel & urinary incontinence.
- ☐ Predisposing diseases e.g. prolonged immobilizations due to spinal cord injuries, Cerebrovascular accidents, etc.

☐ Diseases & disorders such as confusion or dementia that lessen mental awareness.

- ☐ Medication particularly sedatives etc.

3. Hospital related risk factors:

- ☐ Improper care by attendants, nursing staff & doctors.
- ☐ Decreased awareness regarding pressure sores
- ☐ Improper care of impending pressure sores.

We have managed the pressure sore both medical and surgically, which was as follows:

Medical or conservative treatment included:

- ☐ prevention of bed sores
- ☐ postural change
- ☐ treatment of underlying disease
- ☐ wound dressing
- ☐ use of antibiotics
- ☐ Nutritional assessment & supplementation.

Surgical management included:

- ☐ Debridement of necrotic tissue & abscess drainage
- ☐ Direct closure
- ☐ Split thickness skin grafts
- ☐ Full thickness skin grafts
- ☐ Myocutaneous flaps
- ☐ Neurosensory myocutaneous flaps

OBSERVATIONS:

Table 1: Distribution of bed sores in patients in relation to high risk groups:

(Total number of patients= 835)

S.No.	Disease	Bed Sores		Total	Prevalence (%)
		YES	NO		
1.	Quadriplegia	15	42	57	26.31
2.	Paraplegia	14	72	86	16.28
3.	#Pelvis	9	75	84	10.71
4.	#Femur	2	58	60	3.33
5.	Pyrexia	14	92	106	13.21

Cont... Table 1: Distribution of bed sores in patients in relation to high risk groups:

(Total number of patients= 835)

6.	CVA	13	165	178	7.30
7.	Hanging	2	12	14	14.28
8.	Snake Bite	3	41	44	6.82
9.	Encephalopathy	3	27	30	10
10.	GBS	3	16	19	15.79
11.	General (>15 days hospitalization)	5	152	157	3.18
Total:				835	

 $\chi^2=36.067$, df=10, p<0.001, very highly significant

In present study most of the patients are of spinal cord injury cases and that to be are of quadriplegia (26.31%).

Table 2: Distribution of bed sores in patients in relation to gender:

(Total number of patients= 835)

S.No.	Gender	Bed Sores		Total	Prevalence (%)
		YES	NO		
1.	Male	50	383	433	11.55
2.	Female	33	369	402	8.22
Total:				835	

 $\chi^2 = 2.595$, df = 1, p<0.107, not significant

The Prevalence in Male found to be 11.55% that is higher than Female prevalence (8.22%) but results are not significant.

Table 3: Distribution of Bed Sores in relation to Rural Vs Urban population:

(Total number of cases = 83)

S.No.	Territory	No. of cases	Percentage
1.	Rural	61	73.49
2.	Urban	22	26.51
Total:		83	100

 $\chi^2 = 5.868$, df = 1, P<0.05, Significant

In my present study 73% patients of bed sores were from Rural back ground.

Table 4: Level of ESR in Pressure Ulcer Patients

S.No.	ESR Level	No. of cases	Percentage
1.	>20	81	97.59
2.	<20	2	2.41
Total:		83	100

In present study, 97.59% patients of bed sores showed high ESR level (>20)

Table 5: Level of Protein in Pressure Ulcer Patients

S.No.	Protein Level	No. of cases	Percentage
1.	Hypoproteinemia (<6)	49	59.04
2.	Normal	34	40.96
Total:		83	100

The hypoproteinemia which is considered secondary to loss of plasma from the ulcers & associated illness. In present study 59.04% of patients were suffering with hypoproteinemia.

Table 6: Level of Hemoglobin in Pressure Ulcer Patients

S.No.	Hemoglobin Level (gm / dl)	No. of cases	Percentage
1.	Normal	20	24.11
2.	Mild (9-11)	39	46.98
3.	Moderate (7-8)	21	25.30
4.	Severe (<7)	3	3.61
Total:		83	100

In present study 39 patients were mild anemic (Hb level 9 to 11) and 21 patients moderately anemic (Hb level 7 to 8) and 3 patients were severally anemic (Hb level <7).

Table 7: Age wise Distribution of pressure sores in patients:

S.No.	Age Group (Yrs)	No. of Cases	% of cases
1.	1 – 15	4	4.82
2.	16 – 30	22	26.51
3.	31 – 45	16	19.28
4.	46 – 60	20	24.10
5.	61 – 75	15	18.07
6.	76 – 90	6	7.22
Total:		83	100

In present study most of patients sustained spinal cord injury in prime of their life. 22 out of 83 patients were between age group 16 to 30.

Table 8: Comparison of the result of treatment in different grades of bed sores: 83 subjects were taken but certain patients presented with multiple ulcers, in my study each ulcer was taken as a single entity & included in study as single case thus giving total 115 ulcers.

Grades.	No. of bed sores	Healed	Percentage
Grade I	29	18	62.07
Grade II	34	21	61.76
Grade III	44	19	43.18
Grade IV	8	0	0
Total:	115		

In present study healing score was found to be greatest in Grade I (62.7%), as compared to other grades.

Results

In present study a total number of 835 patients were included and it was seen that most of the patients were of spinal cord injury cases mainly suffering from quadriplegia (26.31%). In present study overall prevalence of pressure sores was 9.94%. In the present study prevalence was found high in spinal injury patients [$P < 0.001$] and was highly significant

(**Table 1**). Prevalence of pressure sores was found to be more in males compared to females (ratio 1.5:1). But the results are not significant [$p < 0.107$] (**Table 2**). Percentage of pressure sore was high in rural patients (73.49%) and result was significant [$p < 0.05$]. (**Table 3**) Hemoglobin levels, protein levels & ESR values results suggest that patient afflicted with pressure ulcer showed mild anemia in 46.98% of cases,

moderate anemia in 25.30% cases. 59.04% patients presented with hypoproteinemia and 97.59% patients showed increase ESR. **(Table 4& 5)**

In present study 39 patients were mild anemic (Hb level 9 to 11) and 21 patients moderately anemic (Hb level 7 to 8) and 3 patients were severally anemic (Hb level <7). **(Table 6)** In present study most of patients sustained spinal cord injury in prime of their life. 22 out of 83 patients were between age group 16 to 30. **(Table 7)** In present study healing score was found to be greatest in Grade I ulcers (62.7%), as compared to other grades. **(Table 8)**

Discussion

Pressure ulcers represent a common but potentially preventable condition seen most often in high-risk populations such as elderly persons and those with physical impairments. The development of pressure ulcers can interfere with functional recovery, may be complicated by pain and infection, and can contribute to excesses in hospital length of stay. The presence of pressure ulcers is a marker of poor overall prognosis and may contribute to premature mortality in some patients. In addition to these adverse health outcomes, the financial impact of treating pressure ulcers is substantial. A Dutch study found that costs associated with care of pressure ulcers were the third highest after those for cancer and cardiovascular diseases^{30,8}. These consequences highlight the value of preventing pressure ulcers. Pressure ulcers can be prevented in many cases, and a targeted preventive approach may be less costly than one focused on treatment of established ulcers.

Prevalence:

The prevalence of pressure sores was determined on 835 patients who were in high risk category according to Braden (1987) scale and who were admitted in M.B. Government hospital. In present study overall prevalence of pressure sores was 9.94%

(83 cases).

This prevalence has been supported by Langemo et al (1991)⁹, Dharamarajan et al (2003)¹⁰. Langemo et al (1991) found that prevalence of pressure sores of 10% to 18% in the general acute care setting, 2.3% to 28% in long-term care facilities, and 0 to 29% in home care settings. Dharamarajan et al (2003) found that prevalence of pressure sores is 3 – 11% in hospitalized patients, 2.5 – 24% in nursing home patients.

In the present study prevalence was found high in spinal injury patients [$P < 0.001$] and was highly significant. The similar study in support done by Krause (1998)¹¹ and Walter et al (2002)¹² have reported pressure ulcer are more common among patients with spinal cord injuries than in non injured population.

The possible cause could be strong association of bed sores with spinal injury patients possibly due to loss of sensation, vasomotor disturbances, spasticity and loss of mobility of the patient.

Gender:

On comparison between males and females pressure sores was found to be more in males compared to females (ratio 1.5: 1). The results are not significant [$p < 0.107$]. However studies done by Lindgren et al (2000) reported that men were as prone to developing pressure sores as women.¹³

The possible cause for higher incidence in males could be, males are more commonly involved in day to day activity and more mobility makes them more prone to accidents and thus puts them under high risk category.

Rural Vs Urban:

In present study on comparison between rural and urban subjects pressure sore found high in rural patients (73.49%) and results was significant [$p < 0.05$].

This was in agreement with the study done by Dang, Halstead, Rose (1999) who reported the health risk is increased for an individual who lives in a rural area where it is difficult to access specialists who identify and manage decubiti.¹⁴

Similar finding have been reported by other workers in India as Shanugasunbrum(1984). This can also be explained by the fact that in India 80% of population lives in villages & illiteracy, lack of medical care increases the risk.¹⁵

NUTRITIONAL STATUS AND BED SORES:

Our results suggest that patient afflicted with pressure ulcer showed mild anaemia in 46.98% of cases, moderate anaemia in 25.30% cases. 59.04% patients were present with hypoproteinemia and 97.59% patients showed increase ESR.

These observations have been documented by Fucocou et al (1997), Graber et al (2000). Hypoproteinemia in pressure ulcer patients is due to three possible factors (1) protein loss from the ulcer (2) Decreased hepatic synthesis and (3) Protein hyper catabolism. 2 and 3 may be secondary to the chronic inflammatory state (increase ESR).¹⁶

In pressure sore patient's anaemia is due to decrease synthesis of transferring by liver in chronic inflammatory state. Anaemia and hypoproteinemia not only an intrinsic risk for development of pressure ulcer but also affect healing.¹⁷

With the above findings it suggests that poor nutritional status puts the patient under risk for developing bed sore, thus can be implemented as preventive measure in high risk group.

AGE RELATED INCIDENCE:

In this study 26.51% patients with pressure sore between age group of 16 – 30 years. In this age, persons are exposed to the dangerous occupation

outside the home where these can sustain dangerous injury. Similar studies done by Philip et al (1979)¹⁸, Key & Retief (1972)¹⁹, Guttman(1973)²⁰ were in support with our results.

MEDICAL AND SURGICAL TREATMENT:

In present study healing percentage was found to be significantly high in grade I & grade II types of bedsores as compared to grade-III & grade-IV. Possible cause for this observation could be that in this study preventive strategies and local treatment of wound care was done, which mainly indicated for grade-I & grade-II type of bedsores. Maximum number of grade-III & grade-IV cases were referred to higher centers for operative repair and follow up was lost.

Hence in this study it was found that subjects with rural background, poor nutritional status and males are at high risk for developing pressure ulcers. Pressure ulcers can be prevented in many cases, and a preventive approach may be less costly than one focused on treatment of established ulcers. Whereas both medical and surgical interventions are necessary in a developed ulcer.

Pressure is exerted on the skin, soft tissues, muscle, and bone by the weight of an individual against a surface beneath. These pressures are often in excess of capillary filling pressure, approximately 32 mm Hg.²¹ In patients with normal sensitivity, mobility, and mental faculty, pressure sores do not occur. Feedback, both conscious and unconscious, from the areas of compression leads individuals to change body position. These changes shift the pressure prior to any irreversible tissue damage.

Other traumatic forces that may be present include shear forces and friction. These forces cause microcirculatory occlusion as pressures rise above capillary filling pressure, resulting in ischemia. Ischemia leads to inflammation and tissue anoxia.

Tissue anoxia leads to cell death, necrosis, and ulceration.²² Irreversible changes may occur after as little as 2 hours of uninterrupted pressure.²³

Individuals unable to avoid long periods of uninterrupted pressure over bony prominences are at increased risk for the development of necrosis and ulceration. This group of patients typically includes elderly individuals, those who are neurologically impaired, and those who are acutely hospitalized. These individuals cannot protect themselves from the pressure exerted on their bodies unless they consciously change position or have assistance in doing so. Even the most conscientious patient with an extensive support group and unlimited financial resources may develop ulceration resulting from a brief lapse in avoidance of the ill effects of pressure²⁴

Many factors contribute to the development of pressure sores, but pressure leading to ischemia is the final common pathway. Tissues are capable of withstanding enormous pressures when brief in duration, but prolonged exposure to pressures slightly above capillary filling pressure initiates ulceration.²⁵

Impaired mobility is an important contributing factor. Moreover, this paralysis leads to muscle and soft tissue atrophy, decreasing the bulk over which these bony prominences are supported.

Contractures and spasticity often contribute by repeatedly exposing tissues to pressure through flexion of a joint. Contractures rigidly hold a joint in flexion, while spasticity subjects tissues to considerable repeated friction and shear forces.²⁶

Sensory loss also contributes to ulceration by removing one of the most important warning signals, pain.

Paralysis and insensibility also lead to atrophy of the skin with thinning of this protective barrier. The skin becomes more susceptible to minor traumatic

forces, such as friction and shear forces, exerted during the moving of a patient. Trauma causing deepithelialization leads to transdermal water loss, creating maceration and adherence of the skin to clothing and bedding, which raises the coefficient of friction for further insult.²⁷

Malnutrition, hypoproteinemia, and anemia reflect the overall status of the patient and can contribute to vulnerability of tissue and delays in wound healing. Poor nutritional status certainly contributes to the chronicity often observed with these lesions. Anemia indicates poor oxygen-carrying capacity of the blood. Vascular disease also may impair blood flow to the region of ulceration.²⁸

Bacterial contamination from improper skin care or urinary or fecal incontinence, while not truly an etiological factor, is an important factor to consider in the treatment of pressure sores and can delay wound healing and may lead to complications like osteomyelitis.²⁹

Mechanical debridement of all nonviable tissue; use of different dressings depending upon the exudates and establishment of a moist wound-healing environment; nutritional supplementation for malnourished patients; physiotherapy, pressure relief for the wound; elimination of drainage and cellulitis is done.³⁰

Improper care by the attendant or staff due to lack of knowledge, unawareness, negligence or illiteracy are also responsible for high incidence of bed sores in Indian population. Availability of the described treatment modalities, in combination with early recognition and regular monitoring, ensures rapid healing and minimizes morbidity, mortality, and costs. Recently introduced dressing materials containing basic fibroblast growth factor, human platelet derived growth factor, epidermal growth factor are certainly helpful but expensive and not affordable by majority

of patients.³¹

Conclusion

Prevention is the key to manage pressure ulcers & it begins with complete medical & nursing care along with risk assessment & thorough patient education. Thus, successful management of pressure sores requires a multidisciplinary approach from multiple fields in which surgery is uniquely suited to play a leading role.

All efforts should be made to prevent them before developing by pressure and frictional relief as later it involves exhaustive procedures, like debridement and dressings, wound care, skin grafting and the need of a plastic surgeon to perform complex procedure

Conflict of Interest: There is no conflict of interest. The study has been cleared from the Institutional Ethical Committee.

References

1. Arnott's hydrostatic bed, London Med. & Surgical Journal.1833; Vol.2nd
2. Jacqueline F. Lavallée, Trish A. Gray, Jo Dumville, Nicky Cullum. Barriers and facilitators to preventing pressure ulcers in nursing homes residents: A qualitative analysis informed by the Theoretical Domains Framework International Journal of Nursing Studies Volume 82, June 2018, Pages 79-89
3. Laurie Kennedy-Malone, Kathleen Rya .Advanced Practice Nursing in the Care of Older Adults.
4. Thomas T. Yoshikawa Nigel J. Livesley Anthony W. Chow. Infected Pressure Ulcers in Elderly Individuals *Clinical Infectious Diseases*, Volume 35, Issue 11, 1 December 2002, Pages 1390–1396
5. Jimmy Choo, Jane Nixon, E Andrea Nelson, Elizabeth McGinnis. Cochrane database of systemic review Autolytic debridement for pressure ulcers, 19 October 2014
6. Berman A, Snyder S, Kozier B, Erb G. Kozier and Erb's Fundamentals of Nursing: Concepts, Process, and Practice. 8th ed. Upper Saddle River, New Jersey 07458: Pearson Education; 2008. p. 917 -27.
7. European Pressure Ulcer Advisory Panel/ National Pressure Ulcer Advisory Panel (NPUAP): Potential risk factors associated with pressure ulcer development. Prevention of pressure ulcers: Quick reference guide. Washington: 2009.
8. Health council of Netherland, Pressure ulcers. *The Hague: health council of the Netherlands*, 1999; Publication 23rd .
9. Langemo DK, Olson B, Hunter S, et al: Incidence and prediction of pressure ulcers in five patient care settings. *Decubitus*. 1991; 4(3):25.
10. Dharmarajan TS, Ahmed S : The growing problem of pressure ulcers: evaluation and management for an ageing population. *Postgrad Med*. 2003;113(5): 77-90.
11. Krause JS: Skin sores after spinal cord injury: relationship to life adjustment. *Spinal Cord*. Jan 1998; 36(1):51.
12. Walter JS, Sachs J, Othman R, et al: A database of self reported secondary medical problems among VA spinal cord injury patients: its role in clinical care and management. *J Rehabil Res Dev*. Jan-Feb 2002; 39(1): 53.
13. erapSayar, Sibel Turgut , HavvaDoğan , AynurEkici , Sabire Yurtsever, Ferit Demirkan, Nurcan Doruk , Bahar Taşdelen. Incidence of pressure ulcers in intensive care unit patients at risk according to the Waterlow scale and factors influencing the development of pressure ulcers, Volume18, Issue5, March 2009Pages 765-774
14. Dang T, Halstead L, Rosen M : Remote evaluation of pressure ulcer for individual with spinal cord injury :a preliminary report on a telerehab project

- ;BMES/EMBS 1999; Vol.2;680
15. Shanmugasuntrum TK: The care of SCI patients in developing nations-can we stem the rot? *Paraplegia* . 1988; Vol 26.no 1
16. Fuocou U et al: Anaemia and serum protein alteration in patient with pressure ulcer. *Spinal cord*. 1997; 35, 58-60.
17. Graber SL, Rintala DH et al: Reported pressure ulcer prevention & management techniques by person with spinal cord injury. *Arch Phy. Med. Rehab*. August 1996; 77(8), 744-9.
18. Philip R, Fine,Keith, V.Kuhlemeier: Spinal cord injury: An epidemio-logical perspective, *Paraplegia*. July 1979;, Vol. 17 No. 2.
19. Key AG, Retief PJM: Spinal cord injuries, An analysis of 300 new lesions. *Paraplegia*. 1972; 7: 243-249.
20. Guttman L: Spinal cord injuries: Comprehensive management and research, Oxford, 1973; *Blackwell Scientific Publications*.
21. Department of Health and Human Services. Repositioning patients in bed. Centers for Medicare and Medicaid Services (CMS) Manual System. 2011;3:100-7.
22. Garcia AD, Thomas DR. Assessment and management of chronic pressure ulcers in the elderly. *Med Clin North Am* 2006;90:924-44.
23. US Department of Health and Human Services. Health care protocol: Skin safety protocol: Risk assessment and prevention of pressure ulcers. Institute for Clinical Systems Improvement, 2nd ed. California: Lippincott Williams and Wilkins; 2007. p. 1926-44.
24. Jun Seongsook RN, JeongIhnsook RN, Lee Younghee RN. Validity of pressure ulcer risk assessment scales; Cubbin and Jackson, Braden and Douglas scale. *Int J Nurs Stud* 2004;41:199-204.
25. Sanjay Kumar et al.; *Sch J Med Case Rep*, November 2015; 3(11):1056-1058
26. Techniques for Wound Healing with a Focus on Pressure Ulcers Elimination Damien P. Kuffler *The Open Circulation and Vascular Journal*, 2010, 3, 72-84
27. Lyder CH; Pressure ulcer prevention and management. *Jama*, 2003; 289(2):223-226.
28. Thomas DR. Prevention and treatment of pressure ulcers: What works? What doesn't?. *Cleveland Clinic Journal of Med*. 2001;68:704- 22.
29. Darouiche RO, Landon GC, Klima M, Musher DM, Markowski J. Osteomyelitis associated with pressure sores. *Arch Intern Med* 1994;154:753-8.
30. Eunice O OsualaInnovation in prevention and treatment of pressure ulcer: Nursing implication 2014 | Volume : 17 | Issue : 2 | Page : 61-68
31. Clinical Effects of Negative Pressure Wound Therapy and Basic Fibroblast Growth Factor in Patients with Pressure Ulcers *Journal of Wound Management and Research* 2018; 14(1): 18-25Seung Ki Ahn, Hwan Jun Choi, Jung Ki Kim, Jun Hyuk Kim, Young Man Lee.