

Original Research Article

Assessment of wound healing in relation to nutritional status of the patients in common surgical condition in tertiary care centre

Rahul Singh¹, Shashank Shekhar Tripathi^{1*}, Ankur Tripathi¹, Himansha Pandey²

¹Department of Surgery, ²Department of Pathology, MLN Medical College, Allahabad, Uttar Pradesh, India

Received: 18 December 2018

Revised: 13 February 2019

Accepted: 14 February 2019

*Correspondence:

Dr. Shashank Shekhar Tripathi,
E-mail: shashanktripathi094@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Wound healing depends upon a balance between general factors which include nutritional status of the patient and local factors. Assessment of wound healing in relation to nutritional status of the patients in common surgical conditions.

Methods: 46 surgical patients admitted in S.R.N. Hospital, Motilal Nehru Medical College, Allahabad during the period from July 2017 to July 2018, were included. Clinical, anthropometric examination, assessment of wound healing and factors affecting wound healing was done.

Results: The mean age of the males patients were 38 years and that of female 33 years. Out of 46 patients included in our study 71.74% were male and 28.26% were females, and among these 15.15% of male and 38.46% female were malnourished. Percentage of wound contraction was 11.38% among the healthy and 2.30% in malnourished group, while the percentage of infection was 14% and 13% among healthy males and female and 20% each for malnourished males and females. Loss of weight was 9.4% and 10.1% among healthy male and female and 6.54% and 7.5% for malnourished male and females. The percentage of wound disruption in our study was 9% among malnourished group.

Conclusions: Wound infection and disruption collectively increased the mortality and morbidity significantly in patients of malnourished group. Socio economic status has indirect correlation with wound healing. Malnourishment has a definite effect on wound healing.

Keywords: Wound healing, Malnourished, Nutritional status

INTRODUCTION

Historically surgeons have been concerned with wounds and healing since the time of Egyptians as evidenced by Edwin S. Smith Papyrus about 500 yrs ago.¹ Wound healing depends upon a balance between general factors which include nutritional status of the patient and local factors.² Knowledge of wound healing allows all concerned, including surgeons and physicians to manipulate the wound, to achieve an optimal result in the shortest period of time. Abdominal wound disrupting factors (eg. coughing, vomiting & distension) are

apparent in most cases of wound failure and are often inevitable. Although surgical and anesthetic advances of 18th and 19th centuries have dramatically improved surgical outcomes, the basic scientific discoveries of 1980's and 1990's promises to allow surgeons and physicians to manipulate wound healing with cellular and molecular biological techniques.³ Besides several factors influence wound healing, we assessed wound healing mainly in relation to the nutritional status of the patients.² The closed wound, which heals in a timely fashion, is sine qua non of a successful surgeon. The least complicated example of wound repair is the healing of a

clean, uninfected surgical incision approximated by surgical sutures. Such healing is referred to as primary union or healing by first intention.⁴ The fate of a wound depends on a variety of factors including nutrients and the ready supply of diffusible oxygen. A mature wound is replaced by scar tissue in most cases. But in a few cases there is wound disruption, which continues to be a major problem following abdominal surgery in particular.

METHODS

Surgical patients admitted in S.R.N. Hospital, Motilal Nehru Medical College, Allahabad during the period from July 2017 to July 2018, were included in this study. Both routine surgical admissions as well as emergency surgical patients were included.

There was no case selection hence all patients were included irrespective of diagnosis, age, sex and religion. The patients of trauma.

Clinical examination

- A detailed history of the disease, relevant personal, family and past history was taken;
- Physical examination for appearance, pulse, blood pressure, temperature and skin condition was carried out;
- Systemic examination of all the systems was done in detail;
- Local examination for the disease status was carried out.

Anthropometric examination

A pre-operative evaluation of the nutritional status of the patients was done by measuring the height, weight mid arm circumference, mid-calf circumference and measurement of sub cutaneous skinfold thicknesses over triceps, anterior abdominal wall and medial aspect of the thigh. Besides this is a clinical note of the nutritional status.

Clinical note of the nutritional status was also taken by seeing build, general appearance, hair for depigmentation or loss of luster; lower palpebral conjunctivae, mucus membrane of oral cavity and tongue for pallor; lips for angular stomatitis and cheilosis; tongue for loss of papillae; skin changes for dryness, loss of pigmentation, lustier or elasticity; nails for clubbing, koilonychia and pallor; edema over feet in ambulatory or over sacrum in lying patients as a sign of gross hypoproteinemia.

In the postoperative period a repeat record of these findings were done at weekly interval, but record of the weight was taken first on second postoperative day and finally at the time of discharge from the hospital.

In these patients the weight was correlated with muscle mass as judged by mid arm and mid-calf circumferences and subcutaneous skin fold thickness.

Examining hemoglobin percentage and total serum proteins, specifically serum albumin.

Repeated postoperatively at weekly intervals. Blood urea examination was also done at admission.

As a result of the assessment of weight the patients were divided into two groups:

- Apparently healthy and
- Malnourished.

In the apparently healthy patients the reduction in weight was less than 15% whereas in the malnourished patients the reduction in weight loss was more than 15% of standard body weight.

Assessment of wound healing

The individual wound was studied as follows:

- Type of wound (incised or open)
- Site
- Size
- Infection

Wound contraction

The size of the wound was measured immediately postoperatively and subsequently at 3 days interval and afterwards up to 10 days.

Epithelialization

The fine marginal epithelial growth which had a bluish tinge was assessed by mean of a strong magnifying glass and categorized into +, ++, +++ on the basis of its breadth. This observation was made along with the measurement of wound contraction.

Suture material used for closure of each layer of abdominal wound was carefully recorded.

Complications

Complications in the form of Erythema, induration, tenderness and infection were carefully recorded. Any wound failure in the form of abdominal wound dehiscence whether complete, superficial or deep was noted and its relation to suture material and site was noted.

Wound collagen

Since collagen is the basis ingredient of wound repair an effort was made to measure collagen in healing wounds as described by Dunphy and Udupa (1955) where a qualitative and subjective assessment of the collagen content of healing wounds was made.⁴ Thin bundles of collagen were recorded as + the most dense, thickest large

bundle was taken as +++ and ++ coming in between these two. For this purpose a biopsy from the wound edge was taken at the end of operation and in disrupted wounds at the day of disruption buy a skin biopsy punch after local injection of 1% xylocaine.

Correlated with infection (local), protein deficiency, suture material, incision, routine or emergency operation, hospital stay.

Accuracy of 200 gms, weight was recorded in the morning hours with only under garments in men and saree in females first on 2nd postoperative and day at the time of discharge Measurement of subcutaneous skinfold thickness was done with a Vernier callipers.

RESULTS

A study to assess wound healing in relation to nutritional status of the patients' in common surgical conditions was carried out at the surgical wards of S.RN. Hospital, an association hospital of MLN Medical College, Allahabad, between July 2017 to July 2018.

There were 46 patients out of which 13 (28.26% were operated in elective OT and 33 (71.74%) in emergency OT. Total number of patients and their various age groups and sex distribution is shown in Table 1.

Table 1: Age and sex distribution.

Age groups (years)	Male		Female	
	No.	%	No.	%
10-20	10	30.30	6	46.16
20-30	5	15.15	0	00
30-40	1	3.03	3	23.08
40-50	6	18.18	1	7.69
50-60	4	12.12	1	7.65
60-70	7	21.22	2	15.38
Total	33	100	13	100
All patients Mean age	38.0	71.74	33.0	28.26
S.D.±	±19.6		±18.3	

There were 33 (71.74%) male and 13 (28.26%) female patients. Amongst the male patients largest number 10 came in the age group of 10-20 followed by 21.22% in 60-70 years age group, 18.18% in 40-50 years age group, subsequently 15.15% in 20-30 years, 12.12% in 50-60 years and least 3.03 in age group of 30-40 years of age.

Likewise maximum female 46.16% came in age group of 10-20 years, 23% in 30-40 years, 15.38% in 60-70 years, 7.69% in 40-50 years and least 7.65% came in age group of 50-60 years of age.

Patients with a body weight of less than 15 percent of standard weight as shown on the chart (Tables A, B and C were classified as "malnourished" patients. Other

patients with a normal body weight or where the body weight was up to 15% lower than normal were categorized as "healthy" patients. Table 2 shows a detailed distribution of body weight.

Table 2: Showing hemoglobin percentage and serum proteins.

Observations	Healthy		Malnourished	
	Male	Female	Male	Female
Haemoglobin	12.11 ±1.40	10.95 ±1.70	10.99 ±1.70	10.03 ±1.20
Total serum proteins	7.93 ±1.07	7.28 ±1.08	6.15 ±1.68	6.24 ±2.59
Serum albumin	4.97 ±0.85	4.34 ±1.04	3.40 ±1.12	3.28 ±1.65

As shown in Table 2 among the males (33), 28 are in healthy group while 5 are in malnourished group. In the same way among females 8 re healthy and 5 are in malnourished group.

By the physical appreciation of pallor (anaemia) (Table 3), showed that in male patients 7.14% in the healthy group 60% in the malnourished group appeared pale, but in the female group 62.5% females in the healthy group appeared anaemic on clinical examination.

Table 3: Percentage contraction in incised wounds in healthy and malnourished groups.

	Incised	
	Healthy	Malnourished
Number	36	10
Initial wound length/area	15.1±3.9	14.87±4.72
Length of healed scar	13.38±3.85	14.52±4.51
Percentage contraction (%)	11.38	2.35

The built of the patient was divided into average and poor (Table 3).

In the healthy group 11% males and 25% females were of poor built. Whereas in malnourished group 40% males and 60% females were of poor built.

Anthropometric examination of the patients was carried out for mid-arm circumference, mid-calf circumference and subcutaneous skin fold thicknesses over the triceps, anterior abdominal wall and medial aspect of the thigh. The mean mid arm circumference was 22.46 (±3.49) cm in males and 21.95 (±3.88) cms in females of healthy group. In the malnourished group it was 19.71 (±3.08) cms. In males and 18.88 (±2.43) cms. In females. Changes in subcutaneous skin fold thickness correlated significantly with the body weight.

The mean mid arm circumference was 22.46 (± 3.49) cm in male and 21.95 (± 3.88) cm in female of healthy group. In malnourished group it was 19.71(± 3.08) cms in male and 18.88 (± 2.43) cms in females.

Anthropometric examination of MCC showing a mean of 27.03 (± 0.75) cm in male and 29.25 (± 0.45) cm in females of healthy group. While in malnourished group it was 22.20 (± 2.14) cm in male and 23.28 (± 1.64) in females.

Anthropometric examination of the subcutaneous skin fold thickness showing a mean of 5.23 (± 0.67) mm for triceps, 6.68 (± 2.91) mm for anterior abdominal wall and 8.75 (± 2.10) mm for medial aspect of thigh in male and 11.06 (± 2.66) mm for triceps, 16 (± 5.06) for anterior abdominal wall and 20.25 (± 4.72) mm for medial aspect of thigh in females of healthy group. While in malnourished male its 4.72 (± 1.48) mm, 5.3 (± 1.32) and 7.8 (± 1.43) mm for triceps, anterior abdominal wall and medial aspect of thigh respectively and for malnourished females it is 7.2 (± 1.1) mm medial aspect of thigh respectively.

All patients were investigated for hemoglobin and serum proteins besides other routine investigations for TLC,

DLC, urine. The mean hemoglobin was 12.11 (1.4 \pm) gm% in Healthy group and 10.99 (± 1.70) gm and 10.03 (± 1.20) gm% in malnourished groups of male and female respectively.

The serum albumin was 31.69% and 24.42% lower in malnourished male and females respectively.

Type of wound

In all cases the wound was surgically created incised wound. The incisions were made in classically described ways and primary closure was done in all patients.

In the healthy patients, total contraction of the incised wound was 11.38% while it was 2.35% in the malnourished patients.

In 5 patients who had wound complications of infection or dehiscence collagen studies were carried out under microscope. In the healthy group the collagen bundles were thick tightly arranged and there was no interstitial edema, but in the malnourished patients there was interstitial edema and collagen bundles were thin and loosely arranged.

Table 4: Wound complications and morbidity.

Complications	Healthy				Malnourished			
	Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%
Infection	4	14	14	13	1	20	1	20
Disruption	2	7	0	0	0	0	1	20
Mortality	0	0	0	0	0	0	1	20
Average hospital stay in days	12	-	13	-	24	-	24	-

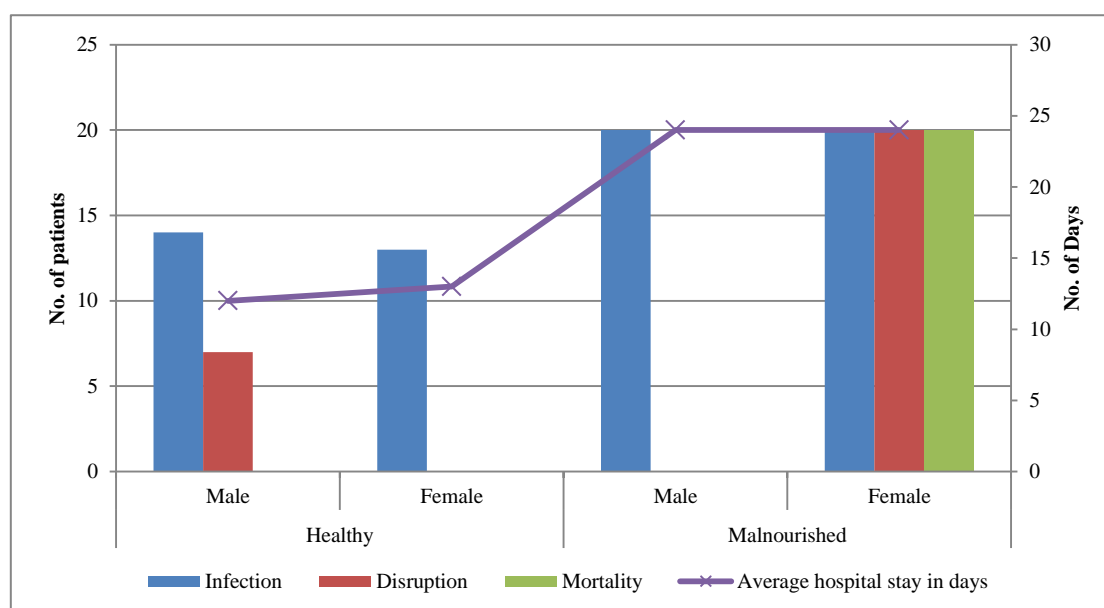


Figure 1: Sex distribution.

Table 5: Site of incision, correlating with wound healing.

Incision	Healthy		Malnourished	
	Male	Female	Male	Female
	No.	Burst	No.	Burst
Midline	23	2	5	0
Subcostal	2	0	1	0
Renal incision	2	0	0	0
Grid iron	1	0	2	0
Total	28	2	8	0

Table 6: Socio-economic status.

Group	Healthy		Malnourished	
	Male	Female	Male	Female
Socioeconomic status	N (%)	N (%)	N (%)	N (%)
Good	4 (14.28)	0	0	0
Fair	16 (57.14)	3 (62.5)	2 (40.0)	2 (40.0)
Poor	8 (28.57)	3 (37.5)	3 (60.0)	3 (60.0)

Wound complications**Infection**

Presence of cellulites or frank pus discharge from the wound was present in 14% and 13% in healthy males and females as compared to 20% and 20% in malnourished males and females respectively.

Disruption

Complete wound break down in abdominal incisions (Burst abdomen) was noted in 7%.

Mortality

One out of 10 among malnourished.

Hospital stay (morbidity)

Total hospital stay was 12 days and 13 days in healthy groups of male and female respectively. In the malnourished patients the Hospital stay was nearly double at 24 days and 24 days in males and females respectively.

Factors influencing wound healing

Nutritional status of the patients, diagnosis, site of incision in abdominal wound along with suture material used and socio-economic status were studied in relation to the wound healing. The rate of contraction of wound, rate of infection, hospital stay, mortality show that body weight hence nutrition is the most important factor influencing wound healing.

During the hospital stay, the loss of weight was significantly more in healthy patients as compared to malnourished whose weight appeared to remain static.

In a total of 46 laparotomy wounds, the effect of site of incision upon the wound healing was examined.

The complication of burst abdomen was 9% in total. The incidence was more among the malnourished patients. It was only 6% among healthy patients where as 20% among the malnourished patients.

The socio economic status of the patient was poorer in malnourished group and it did not correlate directly and significantly with the rate of wound complication, mortality or morbidity.

DISCUSSION

The present study was carried out to find out the outcome of the surgical patients, in relation to their nutritional status. We also tried to find out whether the nutritional status of the patient has any relation with post of complication, duration of hospital stay and mortality. The study was conducted on 46 patients, in S.R.N. Hospital; an associated hospital of Allahabad Medical College, Allahabad during July 2017 to 2018.

As suggested by Dunphy and Udupa we also did subjective assessment of collagen in healing wounds.⁴ When examined under the microscope, collagen bundle appeared large, compacted, thick, without any interstitial edema in normally healed wound of a healthy patients. But collagen bundles were small, thin, loosely arranged with interstitial edema in a disrupted wound of nutritionally poor patient. These patients had low level of serum protein which might be responsible for poor collagen synthesis leading to poor wound healing resulting in disruption (Table 2). According to Bollet and Owens; Prevost and Butterworth; Dyre and Dawson; Moore and Brennan; Hill et al; Irvin and Mullen et al, the impaired nutrition in surgical patients is recognized

increasingly and according to them height and weight is a valuable routine measurement to find out nutritional status of the patient.⁵⁻¹⁰ But at the same time Bistrian et al and they said that serum albumin is a superior measurement for measuring nutritional status.¹¹

Hill et al and Bistrian et al found that weight is not a reliable data and they found that serum albumin is a superior measurement for measuring nutritional status.^{9,11} We also found that total serum protein in healthy patients was higher than malnourished one. Kumar also found that height and weight is a reliable parameter to assess the nutritional status of the patient.¹² In present study we have also relied on height and weight to categorize the patient in healthy and malnourished group.

Among the healthy male and females the total serum protein was 7.93 and 7.28 respectively, while it was 6.15 and 6.24 for malnourished male and female respectively (Table 2).

According to McWhirter, Pennington, measurement of triceps skin fold thickness provides an estimate of body fat reserve while mid arm circumference is a useful measure of muscle protein store and weight loss is accompanied by corresponding changes in triceps skin fold thickness and mid arm muscle circumference.¹³

As described by McWhirter and Pennington; weight loss is accompanied by corresponding change in the mid arm circumference.¹³ In our study also the mid arm circumference of the healthy male is 22.91 cm and female is 23.71 cm. While among the malnourished group its 19.50 cm and 18.47 cm respectively which is in conformity to the above study.

In the same way the measurements for mid-calf circumference as also more for healthy group than the malnourished ones its 27.03 cm and 29.25 cm for healthy male and female and 20.22 cm and 23.26 cm for malnourished male and females.

Our results are in confirmation to the study which was conducted by McWhirter and Pennington; they found in their study that weight loss is accompanied by corresponding change in mid arm circumference and triceps skin fold thickness.¹³

In our study the triceps skin fold thickness of healthy males were 5.23 and malnourished were 4.72 mm while that of females were 11.06 mm while that of malnourished females were 7.2 mm, following the same pattern the subcutaneous skin fold thickness of anterior abdominal wall and medial aspect of thigh was more in healthy male and females than the malnourished group.

In a study conducted by Blackburn et al, a significant protein calorie malnutrition of birth moderate and severe degree was identified by the criteria of with/height,

triceps, skin fold thickness, arm muscle circumference or recent serum albumin value (Table 2).¹⁴

Finkelstein, Gajie and Atesa in their study correlated weight of the patients and their surgical outcome.¹⁵

Giner, Laviano et al conducted a study on 129 patients dividing them in well nourished and malnourished group based on serum albumin level and height /weight ratio and found that 43% patients were malnourished.¹⁶

In our study there were 46 patients out of which 33 (71.74%) males and 13 (28.26%) females. Among the male patients 15.15% and among females 38.46% were malnourished. So percentage of malnourished females in our study correlates well with the above studies.

In our study the criteria for dividing the patients in healthy and malnourished group is the ratio of their height and weight; as done in many previous studies.²

It was described as early as by Thompson and Coworkers and later by hundred on studies that malnourished has impaired wound healing.

The same fact was found in our study also; the percentage of contraction (the final step of wound healing) among the healthy group was 11.38% while among the malnourished group it was 2.35% (Table 4).

We found in our study that postoperative weight loss was more among the healthy group which was 9.4% and 10.1% for males and females respectively while it was less 6.54% and 7.5% among the malnourished male and females respectively.

Malnourished patients have impaired wound healing resulting in wound disruption. The study conducted in our set up did show the same result. Here 9% of healthy and 20% of malnourished group of patients had their wound disrupted (Table 4).

Socioeconomic status had no direct correlation with wound healing but it showed an indirect correlation through the nutritional status of the patients. Most of the Patients in healthy group (ahead good or fair socioeconomic status (71% male and 62.5%) of healthy female). Whereas 60% of each male and females in malnourished group were from a low or poor socioeconomic status (Table 6).

CONCLUSION

Body weight in relation to height was found to be the most effective clinical Parameter to assess malnutrition in surgical patients. Lower than 15% or as compared to standard for a particular height indicates malnutrition. Anthropometric data correlated directly and significantly with body weight and are an additional data which help in nutritional assessment of surgical patients. Appearance of

the patients, built and pallor did not help in assessment of nutritional status, particularly in female patients who continued to maintain a healthy look even when malnourished. Serum albumin level correlate directly but poorly with weight loss and anthropometric data, being low in malnourished patients. The mean age of the males patients were 38 years and that of female 33 years. Out of 46 patients included in our study 71.74% were male and 28.26% were females, and among these 15.15% of male and 38.46% female were malnourished. Percentage of wound contraction was 11.38% among the healthy and 2.30% in malnourished group, while the percentage of infection was 14% and 13% among healthy males and female and 20% each for malnourished males and females. Loss of weight was 9.4% and 10.1% among healthy male and female and 6.54% and 7.5% for malnourished male and females. The percentage of wound disruption in our study was 9% among malnourished group. Wound infection and disruption collectively increased the mortality and morbidity significantly in patients of malnourished group. The complication of burst abdomen was 9% in total. The incidence was more among the malnourished patients. It was only 6% among healthy patients where as 20% among the malnourished patients. Socio economic status has indirect correlation with wound healing. Malnourishment has a definite effect on wound healing. Therefore preoperative oral or intravenous hyperalimentation is recommended in malnourished patients, undergoing major and urgent surgical procedures and should be continued in the post-operative period also.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

- Vargas A, López M, Lillo C, Vargas MJ. The Edwin Smith papyrus in the history of medicine. *Rev Med Chil.* 2012;140(10):1357-62.
- Riskin DJ, Longaker MT, Gertner M, Krummel TM. Innovation in surgery: a historical perspective. *Ann Surg.* 2006;244(5):686-93.
- Guo S, Dipietro LA. Factors Affecting Wound Healing. *J Dent Res.* 2010;89(3):219-29.
- Dunphy JE, Udupa KN. Wound healing - A new perspective with particular reference to ascorbic acid deficiency. *Ann Surg.* 1965;144:304-17.
- Bollet AJ, Owens SO. Evaluation of nutritional status of selected hospitalized patients. *Am. Jour. Clin. Nutri.* 1973;26:931-8.
- Prevost EA, Butterworth CE. Nutritional care of hospitalized patients. Abstracted. *Clin Res.* 1974;22:579.
- Dyre NH, Dawson AM. Malnutrition malabsorption in Crohn's disease with reference to the effect of surgery. *Br J Surg.* 1973;60:134-40.
- Moore FD, Brennan MF. Surgical injury: body composition, protein metabolism neuroendocrinology. In: Ballinger WF et al. (ed). *Manual of surgical nutrition.* Philadelphia. Saunders. 1975: 212.
- Hill GL, Blackett RL, Pickford IR, Burkinshaw L, Young GA, Warren JV, et al. Malnutrition in surgical patients - An unrecognized problem. *Lancet.* 1977;1:689-92.
- Irvin TT. Effects of malnutrition hyperalimentation on wound healing. *Surg Gynaecol Obstet.* 1978;147(1):33-7.
- Bistrian BR, Blackburn GL, Scrimshaw NS. Malnutrition: Cellular immunity in the hospitalized patients - Abstracted. *Clin Res.* 1978;21:972.
- Kumar V. A study of nutritional status of surgical patients at SRN hospital, Allahabad, M.S. Thesis (General Surgery), University of Allahabad. 1978: 26-28.
- McWhirter JP, Pennington CR. Incidence recognition of malnutrition in hospital. *BMJ.* 1994;308:945-8.
- Blackburn GL, Bistrian BR. Nutritional care of the injured/or septic patient. *Surg Clin N Amer.* 1976;56(5):1195-224.
- Flnkielman JD, Gajic O, Afessa B. Underweight is independently associated with mortality in postoperative patients admitted to ICU; a retrospective study. *BMC Emerg Med.* 2004;4(1):3.
- Glier M, Laviano A, Michael M, Gleason MJR. In 1995 a correlation between malnutrition poor outcome in critically ill patients still exists. *Nutrition.* 1995;12(1):23-9.

Cite this article as: Singh R, Tripathi SS, Tripathi A, Pandey H. Assessment of wound healing in relation to nutritional status of the patients in common surgical condition in tertiary care centre. *Int Surg J* 2019;6:1247-53.