

## LEUKERGY TEST, A SIMPLE NEW TEST IN THE DIAGNOSIS OF POSTOPERATIVE ORTHOPEDIC WOUND INFECTION

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### Summary

Post operative wound infection is a common problem encountered in many hospitals all over the world. It necessitates the increase in resources loss, the more stay in hospital, the more of economy to spend on to combat. Thus its prevention & monitoring to detect earlier can help to reduce all mentioned resources & efforts. A simple test to predict such an infection besides clinical features & other laboratory tests is recommended. We tried to perform leukergy test on 83 patients, out of 103, who underwent different orthopedic surgical procedures in Basrah General Hospital, along with looking for the existence of postoperative wound infection using clinical manifestations, aided by laboratory tests including complete blood count, estimation of ESR & qualitative determination of CRP. We found that the rate of postoperative wound infection (13.5%) was slightly higher in our study than reported ones. Leukergy test showed a sensitivity of 85.71 % & specificity of 75.36 %, thus positive leukergy test was significantly related to the existence of post operative wound infection & negative result was significantly related to the absence of such an infection.

### Introduction

Post-orthopedic operative wound infections are those that can occur after any operation on bone especially after operations on open fractures & after procedures involving the use of foreign implants. The reported rate after orthopedic operation on broad cross-sectional study varies from 0.2-10 %<sup>1</sup>, while after implant surgery, they seem to be in the range of 0.08-13 % despite the vast advances in surgery in the past decades<sup>2</sup>. They can delay recovery & often increase the length of hospital stay and may produce lasting sequels & require extra resources for

investigation, management & nursing care. Therefore, their prediction & then prevention is relevant to getting higher quality of patient care<sup>3</sup>.

The prediction of postoperative wound infections depends on the cardinal symptoms & signs of infection, the existence of purulent discharge from the wound site or the drain, and the aid of laboratory investigations, including a full blood count, estimation of erythrocyte sedimentation rate, tests for acute phase proteins, like C-reactive protein, & by microbiological examination of any discharged material from the wound<sup>4</sup>.

Leukergy is "the phenomenon in which white blood cells agglomerate in

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the peripheral venous blood". This phenomenon was first identified in 1956 by Fleck<sup>5</sup>. It occurs as well in several metabolic disorders like burns & acute pancreatitis with non-infectious inflammatory conditions, ischemic heart disease, polycythemia rubra vera and some rheumatic diseases. Unlike ESR and CRP, the amount of leukergy has been shown to correlate with the level of activity of the disease besides its simplicity to perform, its inexpensiveness & rapidity<sup>6,7</sup>.

For this purpose, a prospective study was conducted to evaluate the reliability of leukergy test in the prediction of early postoperative, orthopedic wound infection in Basrah Province.

### Materials & methods

During a period of 6 months, 103 patients who underwent many orthopedic operations in Orthopedic Department of Basrah General Hospital, were followed up clinically and by laboratory means (including periodic observations of cardinal symptoms & signs of postoperative wound infections, and by using the available laboratory investigations, including complete blood count, ESR determination, C-reactive protein analysis. From those, 83 patients were subjected to leukergy testing (20 cases were missed for many administrative reasons yet, all showed no feature of postoperative wound infection). The test was performed by using citrated-anticoagulated blood samples collected from patients, from which slanted smears were prepared, which were subjected to repeated freezing & thawing( to lyse red cells). After that, they were fixed with methanol for 20 minutes & then stained with eosin stain (in stead of the original fast red used by Fleck, due to the unavailability of the last). For an agglomerate to be

significant, at least 3 (or more) white cells in contact to each other were considered. The percentage of those WBC agglomerates was obtained by counting at least 300 cells per each sample. More than 10 % agglomerates were considered positive for the study<sup>6</sup>. Statistical analysis of results was performed by obtaining the frequency (percentage), the mean, the sensitivity & the specificity<sup>8</sup>.

### Results

One hundred and three patients were included in the study, the age ranged between 1.5 year to over 80 years with a mean of 32.4 . The age distribution of the patients (Table I) shows that the highest frequency (24.2%), was in the class interval of 20-29 years & that most patients (74.5%) were between 10-49 years( working age) compared to 5.8 % for those who were below 10 & 19.2% who were 50 years & more.

Table II, shows that 14(13.5%) of those patients, had been found to have post operative wound infection, diagnosed by observation of local & general symptoms & signs, laboratory investigations including complete count of blood, ESR determination, & C-reactive protein determination.

Leukergy test was positive in 34.9% (29) of cases under the study (83) (table III). Of those, only 12 cases (14.4%) did genuinely have post-operative wound infection (using all above criteria) and the rest, 17 were negative for postoperative wound infection.

The sensitivity & specificity were calculated according to the following formulas<sup>8</sup>.

$$\text{Sensitivity} = \frac{\text{True positive(a)}}{\text{All positive( a+c)}} \times 100 = \frac{12}{14} \times 100 = 85.71 \%$$

$$\text{Specificity} = \frac{\text{True negative(b)}}{\text{All negative( b+d)}} \times 100 = \frac{52}{69} \times 100 = 75.36 \%$$

Table 4 showed that the sensitivity to predict an early postoperative wound infection was 85.71% while the sensitivity in excluding it was 75.36 %.

### Discussion

In this study, the frequency of postoperative wound infection in Basrah General Hospital was 13.5 %, a result slightly higher than that observed by Onche I, 2003 ( 0,08-13 %)<sup>(2)</sup>. This can be probably attributed to the lower social, environmental hygiene in our locality, besides, the lack of facilities of disinfection in our Hospital due to the difficult situation in which our Country lives now.

It also shows that 34.9% (14) of patients had positive leukergy test, of whom, only 12 (14.4%) were diagnosed to have postoperative wound infection by means of symptoms, signs, CPC, ESR & CRP. Sensitivity of the test was 85.7%, indicating that positive leukergy test is significantly related to the existence of postoperative wound infection, Besides, specificity of the test was 75.3%, indicating that negative leukergy test can significantly exclude the possibility of postoperative wound infection safely. Those results were compatible with those reported by Otremskiet al 1993<sup>6</sup> who found it positive in 25 out of 26 patients with proven bone or joint infection thus, they concluded that leukergy test was more accurate than the ESR, white cell count or blood culture & the percentage of cells agglomerated correlated with the clinical severity of the infection and

the test detected reactivation of the septic process better<sup>3,9</sup>. Abuzaid et al, 2003 had found a more or less a similar result when they found that leukergy test, and CRP were highly significantly increased in children with bacterial infection ( $P < 0.001$ ) while no significant increase in viral infection ( $P > 0.05$ ) in comparison to control group<sup>10</sup>. Besides, Bo-Eisa A et al, 2005, in their review article, stressed that measuring in vitro clumping of venous leukocytes (leukergy) may more closely correlate with severity of infection than the ESR<sup>11</sup>.

### Conclusion

From those results we can conclude that postoperative wound infection is common after orthopedic surgical procedures in Basrah, being more common than other localities and leukergy test with its simplicity and easiness to perform is a very useful test to predict & monitor postoperative wound infection.

### Recommendations

The policy of expanding the use of leukergy test, beside other laboratory tests, is to be encouraged to predict the emergence of postoperative wound infection. However, a wider scale study of leukergy with comparison of its sensitivity & specificity along with other tests for postoperative wound infection (like ESR, quantitative CRP, and microbiological studies) is to be encouraged as well.

Age group (Years)	Number of patients	Frequency (%)
1-9	6	5.8
10-19	15	14.5
20-29	25	24.2
30-39	22	21.3
40-49	15	14.5
50-59	9	8.7
60-69	7	6.7
70-79	3	2.9
80+	1	0.9
Total	103	100

**Table I: The age distribution of patients.**

Postoperative wound infection	Number of patients	Frequency(%)
Positive	14	13.5
Negative	89	86.5
Total	103	100

**Table II: The distribution of postoperative wound infection among postoperative patients.**

Leukergy test	Number of patients	Frequency(%)
Positive	29	34.9
Negative	54	65.1
Total	83	100

**Table III: The distribution of patients according to the results of leukergy test.**

Leukergy test	Postoperative wound infection results				
		+	-	Total	
+	a	12	d	17	29
-	c	2	b	52	54
Total		14		69	83

**Table IV: The sensitivity & specificity of leukergy test among cases.**

## References

- Louis S & David W. Postoperative wound infection, in Graham A. Apleys system of orthopaedic & fractures, 10<sup>th</sup> Ed., 2000, Chap.2: 35-37.
- Onche I, Odetayo O, Aranmolate S & Yinusa W. Risk factors for wound infections after implant surgery, 2003, Nigerian J Orthopedic & Trauma, 2: 101-108.
- International Federation of Infection Control. Education Program for Infection Control. Postoperative infection. <http://www.infec.narod.ru/manual/ssi.htm>.
- Kevin B. General principles of infection: in Campbell, s Operative Orthopaedics. Edited by Terry cannale, S.2003, vol.1, Chap 15: 643-650.
- Cooper S. The ideas of Ludwik Fleck and their application to the eukaryotic cell cycle, The restriction point, and the G1 phase control cooper@umich .edu [cooper@umich.edu](mailto:cooper@umich.edu).
- Otremski I; Newman RJ; Kahn PJ; Stadler J, Kariv N, Skornik Y, and Goldman G. Leukergy – A New Diagnostic Test for Bone Infection. J of Bone and Joint Surgery, Sept 93, vol 75-b, no 5.
- Tuchman I, Frid M., Ben-Hur N.E. Leukergy in major burns. Sept, 1988 Annals of the M.B.C. - vol. 10 – no 2.
- Austin B. Collection of sampling, in Short textbook of medical statistics, 1996, 11<sup>th</sup> Ed. Chap 2:14-16.
- Bacterial Osteomyelitis; Diagnosis and Treatment <http://intmedweb.wfubmc.edu/download/bacterial.doc>
- Abuzaid A M., Ahmady M M. Marzouk A.I., Abd Elsattar B, Biab A.M., ElBaz N.A. Leukergy Test and C-Reactive protein in Bacterial Versus Viral Infection in children. First National Project for Egyptian Child care, 2002. Department of Pediatric and clinical pathology, faculty of medicine, Zagazig University. <http://www.sharkia.net>.
- Bo-Eisa A., Al-Omran S, , Al-Abbad A., Osteomyelitis Review article, 2005, eMedicine.com.