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Dilution of Open Fracture Grade IIIA of the Lower Leg Using Normal Saline 0.9% Mixed With Honey Compared With Normal Saline 0.9% to Minimize the Bacterial Growth

Orthopaedics

KEYWORDS: open fracture, honey, normal saline

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ABSTRACT

Introdution. *Patients with open fracture grade IIIA who were diluted with normal saline, administered antibiotic and perfomred debridement in the operating theatre still had a high incidence of infections. The purpose of the dilution is to lower the bacterial colony, lower the concentration of the bacteria and to flush away any foreign partical or object around the wound. Honey has been used ro treat infected wounds since long time ago. Honey helps to reduce the bacterial colony in wounds that dont respond to conventional antibiotics and antiseptics, this includes Methicillin-Resistant Staphylococcus aureus bacteria. Honey is said to have inhibine factor, this inhibine factor is hydrogen peroxide, that acts as antimicrobial that helps lower the bacterial colony during the dilution of the wound. Using it as a mixture with normal saline in dilution of open fracture wounds will help lower the bacterial colony.* ***Materials and methods.*** *This research was an experimental study, there were 28 patients, their wounds were diluted with mixture of honey – normal saline and with normal saline alone, before and after the dilution bacterial swab was performed to count the bacterial colony.* ***Results.*** *The sample after given the mixture of honey – normal saline, the negative ranks were 12, positive ranks were 0 and ties were 0, this means that the bacterial count was lowere compared to before dilution with the mixture of honey – normal saline. The sample after given normal saline alone, the negative ranks were 13, positive ranks were 1 and ties were 0, this means that the bacterial colony count was lowered compared to before the dilution with normal saline. If both data were compared, the pretest mean rank mixture of honey – normal saline is 12.57 and 16.43 for pretest with normal saline alone. The posttest mean rank of honey – normal saline is 7.50 and 21.50 for postest with normal saline alone.* ***Conclusion.*** *The diluting wounds of open fracture of the lower leg grade IIIA with mixture of honey – normal saline less than 6 hours is more effective compared dilution with normal saline alon in lowering the bacterial count in patients with open fracture of the lower leg grade IIIA*

Introduction

The incidence of traffic accidents in Indonesia has increased from 2007 (48.508 cases) to 2008 (59.164 cases) and in 2009 (62.960 cases). As one of many results of the accident is fracture of the long bone.

These fractures are at risk for an impaired healing due to any connection with external environment. Contamination of open fracture wounds in the hospital Dr. Hasan Sadikin in 1994 amounted to 55.1% and in 1998 amounted to 91%. One of the conditions of handling patients with open fractures was cleansing the wound, which is a very important besides administration of appropriate antibiotic according to the bacterial culture, and immobilizing fracture segments with external fixation, and is one of the keys to prevent any infection in open fractures because it can dilutes the concentration of bacteria, removing foreign bodies in the wound and reduce the number of bacterial colonies.

Various ways have been attempted to reduce the number of colonies of germs in patients with lower extremity wounds open fractures grade III A, by cleansing the wound with 0.9% NaCl, washing wounds using boiled water, using a mixture with povidone iodine, but the infection rate is still high in patients with open fractures of lower leg grade III A, therefore the author have an idea of using a mixture of 0.9% NaCl and honey. The purpose of cleansing the wound with 0.9% NaCl is to dilute the concentration of bacteria, remove foreign bodies in the wound, so that when debridement is done, the number of colonies of bacteria and germs has been reduced. Honey has an anti-bacterial activity and *inhibine* factors which can decrease the incidence of infection so that honey can be used in patients with open fractures degrees IIIA. Hydrogen peroxide is produced by honey after reaction with the enzyme glucose oxidase which becomes active when the honey is diluted. The use of honey as a mixture with NaCl 0.9% in irrigating fracture lower leg injuries grade IIIA will help lower the number of colonies of germs that will reduce the incidence of infection.

The purpose of this study was to evaluate the use of a mixture of NaCl 0.9% - honey on the wound irrigation in open fractures of lower leg grade IIIA in the ER is the same, better or worse in reducing the number of bacteria colonies after washing compared to using 0.9% NaCl.

Material and Methods

This research is an experimental study by comparing the wound diluted using 0.9% NaCl and honey mixture and 0.9% NaCl alone.

These research subjects have to meet the inclusion and exclusion criteria. Inclusion criteria included: age 16-55 years, patients injured lower limb fractures open degrees IIIA caused by traffic accidents who have not received medical procedures such as irrigation and administration of prophylactic antibiotics since the accident, which is less than or equal to 6 hours. The exclusion criteria is when the subject is under treatment of antibiotics or corticosteroids.

The procedure of the study include informed consent and filling the consent form, identity record, wound irrigation by using a mixture of 0.9% NaCl and honey for the first group and irrigation of the wound with NaCl 0.9% only for the second group, and last, sample taking with simple random sampling.

Wound cleansing on the subjects of the first group use a mixture of 0.9% NaCl and honey, prepared by injecting 100 grams of honey (weighed with digital scales) by using a 50 cc sterile syringe container into 500 mL kolf of NaCl 0.9% at Hasan Sadikin Hospital emergency department. Wound cleansing on the subjects in the second group use plain 0.9% NaCl. Irrigation technique is based on pressure irrigation system for open fracture wounds that uses as much as 9 liters of fluid conducted in the ER by pressing the packaging of 0. 9% NaCl until it was emptied.

A sample was taken from the base of the wound before and after dilution by using a sterile cotton swab stick at the bottom of the wound from both groups of research subjects and was put into a sterile test tube by author assisted by a trained assistant then taken to the laboratory of Clinical Pathology Department of Clinical Microbiology Division Hasan Sadikin General Hospital.

The sample was taken from the test tube by using a loop stick ose of 10 microns, then the sample is grown / cultured in a petri dishes with Mueller-Hinton media and kept in an incubator at 37 ° C for 24 hours. After 24 hours, the growing bacteria is counted.

The bacteria count is carried on the 2nd day directly by counting the number of colonies one by one based on the growing bacteria on the petri dishes with Mueller-Hinton media.

Furthermore, the data acquired is analyzed with non-parametric statistical tests Wilcoxon signed-ranks for the paired data and

MannWhitney test for independent data in setting of pvalue by using SPSS version 13.0

Results

Analyzing the obtained statistical characteristics such as age, gender, and extensive wounds is in accordance with Table 1.

Table 1 Patient characteristics

Characteristics	NaCl 0.9% - honey (n=14)	NaCl 0.9% Value – p (n=14)	
Gender			
Male	13	11	0,280*
Female	1	3	
Age (years old)			
Mean (Deviation Standard)	35,43 (10,61)	29,64 (11,87)	0,890**

*) Chi Square test
**) Independen Sample T Test

Based on Table 2, note a smaller number of bacteria colonies after dilution with NaCl 0.9% and honey compared with before dilution (negative difference) is found in 12 samples and has the rank number (R1) of 78.00 , while 2 samples showing the same number of bacteria colonies after and before dilution, and no samples shows a greater number of bacteria colonies after dilution (positive difference).

Table 2 The difference between Bacterial colony before and after irrigating the wound of Open Fracture of lower leg grade IIIA with mixture of NaCl 0.9 % and Honey

		N	Mean Rank	Sum of Ranks
NaCl 0.9% - honey (PostTest) - NaCl 0.9% - honey (PreTest)	Negative Ranks	12	6,50	78,00
	Positive Ranks	0	0,00	0,00
	Ties	2		
	Total	14		

Statistical two paired sample tests were performed with SPSS, results in Z value of -3.163. The difference of two samples tested by Asymp Sig (2-tailed) obtained the value 0.002. This means that there is significant difference between the data before and after the group was given the dilution of NaCl 0.9% and honey mixture.

Table 3. Statistical test of difference between Bacterial colony before and after irrigating the wound of Open Fracture of lower leg grade IIIA with mixture of NaCl 0.9 % and Honey

	NaCl 0.9% - madu (PostTest) - NaCl 0.9% - madu (PreTest)
Z	-3,163
Asymp. Sig. (2-tailed)	0,002

The same experiment was done using 0.9% NaCl without the mixture of honey. A smaller number of bacteria colonies after dilution with NaCl 0.9% compared than before dilution (negative difference) is found in 13 samples and has the rank number (R1) of 95.00, no samples showing the same number of bacteria colonies after and before dilution, and a greater number of bacteria colonies after dilution (positive difference) is found in 1 sample and has the rank number (R2) of 10.00.

Table 4 The difference between Bacterial colony before and after irrigating the wound of Open Fracture of lower leg grade IIIA with NaCl 0.9 % alone

		N	Mean Rank	Sum of Ranks
NaCl 0.9% (PostTest) - NaCl 0.9% (PreTest)	Negative Ranks	13	7,31	95,00
	Positive Ranks	1	10,00	10,00
	Ties	0		
	Total	14		

Statistical two paired sample tests were performed with SPSS, results in Z value of -2.765. The difference of two samples tested by Asymp Sig (2-tailed) obtained the value 0.006. This means that there is significant difference between the data before and after the group was given NaCl 0.9% dilution.

Table 5. Statistical test of difference between Bacterial colony before and after irrigating the wound of Open Fracture of lower leg grade IIIA with NaCl 0.9 % alone

	NaCl 0.9% (PostTest) - NaCl 0.9% (PreTest)
Z	-2,765
Asymp. Sig. (2-tailed)	0,006

U Mann-Whitney test was done with the help of SPSS version 13.0 app, the result is as following:

Table 6 Number of Rank Group pretest and posttest data

	Group	N	Mean Rank	Sum of Ranks
PreTest	NaCl 0.9% - honey	14	12,57	176,00
	NaCl 0.9%	14	16,43	230,00
	Total	28		
PostTest	NaCl 0.9% - honey	14	7,50	105,00
	NaCl 0.9%	14	21,50	301,00
	Total	28		

There is a significant difference in the reduction in the number of colonies of bacteria in the samples that were given 0.9% NaCl and honey, as compared to the samples that were given 0.9% NaCl.

Table 7 Statistics Test-U group pretest and posttest data

	PreTest	PostTest
Mann-Whitney U	71,000	0,000
Wilcoxon W	176,000	105,000
Z	-1,557	-4,885
Asymp. Sig. (2-tailed)	0,119	0,000
Exact Sig. [2*(1-tailed Sig.)]	0,227	0,000

There was no significant difference between pretest data group classes that were given a mixture of NaCl 0.9% - honey and pretest data that were given NaCl 0,9% alone. But there are significant differences between post test data group classes by a mixture of 0.9% NaCl with honeyclass and post-test data by NaCl 0.9%.

Discussion

The purpose of open fractures management is to restore the normal or optimal function of a limb as soon as possible. Thus, it is important to prevent the wound from infection. One of the attempts is cleansing the wound to reduce the number of bacteria colonies so it can dilute the concentration of contaminants and bacteria.

The nature of honey with a high level of osmolarity is caused by the high sugar levels which dilute the product from microbial and stop the growth of all microbial species. It contains *glucose oxidase* enzyme so that when the honey is diluted, it will produce a low concentration hydrogen peroxide which has an antiseptic and antimicrobial effect. Honey can also create a moist environment by reducing the lymph fluid from the wound tissue through a high osmotic work. Debridement effect of honey is caused by protease enzyme by releasing hydrogen peroxide. In this study, there are 28 patients, 14 patients underwent dilution with a mixture of 0.9% NaCl and honey, and 14 other patients underwent dilution with 0.9% NaCl alone. The data were compared and it showed that dilution with a

mixture of 0.9% NaCl with honey will reduce the number of bacteria colonies significantly compared to those wounds diluted with NaCl 0.9% alone.

Conclusion

The conclusion of this study is that there is a significant difference between dilution using mixture of normal saline – honey compared to dilution with normal saline only in lowering the bacterial count.

References

1. Anonim. Jumlah Kecelakaan dan Korban kendaraan Bermotor Berdasar Tingkat Kecelakaan.Diakses dari http://gis.dephub.go.id/mapping/Statistik/Darat/Tabel_A_1_4_01.htm pada tanggal 26 Juni 2012.
2. Solomon L, Warwick DJ, Nayagam S. Principles of fractures. In: Apley's System of Orthopaedics and Fractures. 9th ed. London: Arnold; 2010.
3. Andrew N. Pollak., Alan L. Jones. Renan C. Castillo, MS, Michael J. Bosse., Ellen J. MacKenzie., and the LEAP Study Group. The Relationship Between Time to Surgical D´ebridement and Incidence of Infection After Open High-Energy Lower Extremity Trauma. J Bone Joint Surg Am Vol.92, 2010: p.7-15.
4. Zalvaras CG, Marcus RE, Levib LS, Patzakis MJ. Management of Open Fractures and Subsequent Complications. JJ Bne Joint Surg Am Vol.89, 2007: p.884-95.
5. Sittanggang AL. Tesis: Hubungan antara Jumlah Kuman Pradebridemen dan Pascadebridemen dengan Terjadinya Infeksi Luka Operasi pada Kasus Fraktur Kruris Terbuka Di RSHS Sejak 1 Mei 1992 - 30 September 1993. Bandung: Universitas Padjadjaran; 1994.
6. Nursjamsi N. Tesis: Efektivitas Sefotiam dan Kombinasinya dengan Netilmisin untuk Menurunkan Jumlah Bakteri pada Luka Patah Tulang Tibia Terbuka Tingkat III. Bandung: Universitas Padjadjaran; 1998.
7. Brinker MR, editor. Principles of fractures, In: Basic Sciences. 3rd edition. Philadelphia: W.B Saunder; 2000.
8. Gustilo, Ramon B. Anderson John T. Prevention I The Treatment Of One Thousand and Twenty-Five Open Fractures Of Long Bones: Retrospective and Prospective; The Journal of Bone & Joint Surgery-jbjs.org Vol. 58-A, 1976: p. 453–458.
9. Kanu Okkie, BA, and Timothy Bhattacharya. Trends in the Management of Open Fractures. The Journal of Bone & Joint Surgery-JBJS.org Vol. 88-A, 2006: p.12.
10. Anglen JO. Wound Irrigation in Musculoskeletal Injury. J Am Acad Orthop Surg Vol.9. 2001: p.219.
11. Jeffey O. Anglen. Comparison of Soap and Antibiotic Solutions for Irrigation of LowerLimb Open Fracture Wounds. The Journal of Bone & Joint Surgery • JBJS.org Volume 87A, 2005 : p.7.
12. Charalampos G. Zalavras., Randall E. Marcus., L. Scott Levi., Michael J. Patzakis. Management of Open Fractures and Subsequent Complications. J Bone Joint Surg Am, Vol.89. 2007: p.884-895.
13. Jamalludin, I. Tesis: Penilaian Hasil Hitung Jumlah Koloni Kuman Pre dan Pasca Debridement Pertama pada Luka Patah Tulang Tungkai Bawah Terbuka Tingkat III A dengan menggunakan Air Matang dibandingkan Nacl 0.9 % Di RSHS Bandung Oktober 1998 – Maret 1999. Bandung: Universitas Padjadjaran: 1999.
14. Molan P., Potential of Honey in the Treatment of Wounds and Burns. American Journal of Clinical Dermatology Vol.2. 2001: p.13-9.
15. Dilnawaz Sheikh., Shams Zaman., Baqir Naqvi., Rafi Sheikh, M., Ghulam Ali. Studies on the Antimicrobial Activity of Honey. Pakistan Journal of Pharmaceutical Sciences. Vol. 8(1), 1995: p.51-62.
16. Dunford C CR, Molan PC. The Use of Honey in Wound Management. Nursing Standard Vol.15 (11). 2000: p.63-8.
17. Willix D. J., Molan P. C., Harfoot C. J. A comparison of the Sensitivity of Wound Infecting Species of Bacteria to the Antibacterial Activity of Manuka Honey and Other Honey. Journal of Applied Bacteriology Vol.73. 1992: p.388;94.
18. Allen, K.L., Molan, P.C. and Reid, G.M. The Variability of the Antibacterial Activity of Honey. Public library of science. Vol.4, 1991: p.114 121.
19. Bang L. M., Buntting C., Molan P. C. The Effect of Dilution on the Rate of Hydrogen Peroxide Production in Honey and Its Implications for Wound Healing. Journal of Alternative and Complementary Medicine Vol.9 (2), 2003: p.267;73.
20. Pruitt K. M., Reiter B. Biochemistry of Peroxidase System: Antimicrobial Effects. In:Pruitt KM & Tenovuo JO (Eds). The Lactoperoxidase System: Chemistry and Biological Significance. New York: Marcel Dekker, 1985: p.144;78.
21. Hyslop P. A., Hinshaw D. B., Scraufstatter I. U., Cochrane C. G.et al. Hydrogen peroxide as a Potent Bacteriostatic Antibiotic: Implications for Host Defense. Free Radical Biology and Medicine, Vol. 19 (1), 1995: p.31;7.
22. White, R. J. Molan, P.C. A Summary of Published Clinical Research on Honey in Wound Management. In: White, R. J.; Cooper, R. A; Molan, P. C. (eds.) Honey: A Modern Wound Management Product. Aberdeen: Wounds UK Publishing, 2005: p.130;142.
23. Molan, P. Hill, C. Quality Standards for Medical Grade Honey. In: Cooper, R.; Molan, P. White, R. (eds.) Honey in Modern Wound Management. Aberdeen: Wounds UK Publishing, 2009: p.63;79.
24. Anonim. Pertanian D. Madu Murni Nusantara. Diakses dari www.maduperhutani.com pada tanggal 12 Januari 2008.
25. Sumardika D. Tesis: Pengaruh Madu Topikal Terhadap Tingkat Kecepatan Perbaikan Kerusakan Kulit Leher Pascaradioterapi Karsinoma nasofaring. Bandung: Universitas Padjadjaran: 2013.
26. Andri F. Tesis: Pengaruh Penggunaan Campuran Povidone Iodine 5% dengan Madu Murni Dibandingkan hanya dengan Menggunakan Povidone Iodine 5% saja pada Penyembuhan Luka Laserasi di Punggung Kaki. Tesis. Bandung: Universitas Padjadjaran: 2011.
27. Thompson JC. Netter's Concise Orthopaedic Anatomy, 2nd edition. Saunders: 2010.
28. Parwati I TD. Peta Bakteri dan Kepekaan terhadap Berbagai Antibiotika Tahun 2013. Bandung: Bagian Patologi Klinik Rumah Sakit Dr. Hasan Sadikin Fakultas Kedokteran Unpad: 2013.
29. Christopher J. Lenarz., J. Tracy Watson., Berton R. Moed., Heidi Israel., RN, J. Daniel Mullen., James B. MacDonald. Timing of Wound Closure in Open Fractures Based on Cultures Obtained After Debridement. J Bone Joint Surg Am Vol.92. 2010: p.1921-6.
30. Mahon CN. Manuselis Jr G. Textbook of Diagnostic Microbiology. New York: W.B Saunders Company: 1995.
31. Abuharfeil N A-OR, Abo Shehada M. The Effect of Bee Honey on the Proliferative Activity of Human B and T Lymphocytes and the Activityof Phagocytes. Food and Agricultural Immunology Vol.11. 1999: p.16977.
32. Molan. The Potential for Using Honey to Treat Wounds Infected with MRSA and VRE. World wide wounds. 2000.
33. Fakoor, M., Hassan Pipelzadeh, M. A Study On The Healing Effect Of Honey On Infected Open Fractures wounds. Pak J Med Sci May - June 2007 Vol. 23 No. 3 327-329.
34. Cooper RA MP, Khrishnamoorthy L, Harding KG. Manuka honey used to heal a recalcitrant surgical wound. Eur J Clin Microbiol Infect Dis. 2001;20:858-729