Bmed-H
e-ISSN: 2582-7405
Transaction on Biomedical Engineering Applications and Healthcare
Vol-1 Issue-1, October 2020

Comparison of the Effect of Boiled Cotton Swabs, Alcohol Swabs and without Swabbing on Skin Infection before an Injection

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Abstract

Skin infection is a type of infection that can be caused by bacteria, fungus, viruses or parasites. Nowadays, the world is going through a critical time which has affected the people in many ways and therefore, the people need to take care of their health and health-related problems to save the cost and time without compromising health. For the treatment of skin related infections, the medical professionals uses injections in order to make the patient comfortable and safe. Recommendations about the need to use alcohol before injection of the vaccine are contradictory and based on proof at low rates. Alcohol is used to disinfect the skin prior to injections in order to prevent infections caused by bacteria on the skin being injected within tissue. Alcohol has been shown to be good disinfectant, reducing the number of bacteria on skin by 47-91%. The preparation of skin of the patient before injection is generally done by washing the skin that is visibly soiled or dirty. Swabbing of the clean skin before giving an injection is unnecessary. If swabbing with an antiseptic is selected for use, use a clean, single-use swab and maintain product-specific recommended contact time.Therefore the idea of preparation for the injection site came into effect, but there are different recommendations for preparation of the skin before injection leaving nurses in confusion, and they took up the present analysis.

Keywords

Alcohol, Antiseptic, Disinfectant, Skin infection, Swabbing, Treatment, Vaccine.

INTRODUCTION

Various health authorities around the world have detailed recommendations outlining best methods for administering vaccines. For certain nations, for example Canada, this policy involves pre-injection washing of the skin with alcohol.Alcohol skin washing is a common practice resulting from the alcohol's proven efficacy in decreasing skin bacterial counts that has been extrapolated to suggest a lower risk of skin infections[1].Injections are the most common health care procedures performed by nurses at an average rate of 16 billion administrations each year, according to the World Health Organization (WHO) and the Safe Injection Global Network (SIGN).Over the course of childhood vaccine programs approximately 1 billion injections are issued annually[2].

It is believed that the skin is infected with organisms which, when injected into the body by injection needle, may cause pathological changes.Based on this premise, medical students are instructed to have skin prepared by trainee physicians, nurses and patients before injection by washing with some sort of antiseptic to avoid infection at the injection site[3].Since the 19th century, alcohol swab (saturated with 70 percent isopropyl) has been used to prepare the skin before surgery as a highly effective and oldest topical antiseptic.Alcohol destroys most of the vegetative bacteria, but has little effect on fungal spores according to Willium and his colleagues.Another research found that alcohol does not evaporate easily, and that some of it can be transferred to the body with the injection needle through the skin, giving rise to an uncomfortable stinging sensation when used[4].

The WHO (World Health Organisation) recommendation is based on a systematic analysis that finds no signs of infection when subcutaneous insulin injections have missed alcohol skin washing.No alcohol gain recorded from four additional studies including intramuscular, intradermal, and subcutaneous injections of a range of medications, including vaccines.In all research there are methodological limitations that prohibit definitive conclusions from being drawn, including lack of sufficient randomization or blinding, evaluation of skin reactions using non-validated instruments, retrospective data collection and passive recording of adverse events.Including, no study actually tested vaccine injections. In addition, Cook recently summarized 1,010 cases of cellulitis and 360 cases of infectious abscess after vaccination documented in passive surveillance systems, vaccine studies and published papers, and proposed additional randomized trials to investigate this problem[5]. The new health care system is profoundly involved in reducing unnecessary tests, therapies, and procedures, as exemplified by the American Board of Internal Medicine's (ABIM) Choosing Wisely campaign.

A comprehensive systematic review extensively analysed paediatric medical overuse behaviours and outlined the related costs and risks of harm to patients. Alcohol exclusion for skin washing can qualify as an unnecessary treatment because it has not been shown to have an effect on the risk of infection. There are possible advantages to eliminating

e-ISSN: 2582-7405

alcohol swabs, including: 1) reduction to resource usage due to shorter processing time and supplies, 2) reduction of pre-procedural anxiety due to injection alcohol, and 3) reduction of pain due to alcohol monitoring in the tissue during injection[6].

It is supposed that the skin is expected to be infected with pathogens that may cause pathological changes when injected into the body by injection needle. This presumption leads to training medical students, trainee physicians, nurses, and patients to have pre-injection skin prepared by washing with some sort of antiseptic to avoid infection at the injection site.The alcohol swabs have been used from earlier times to sterilize the injection site prior to injection. But then there was evidence that alcohol causes discomfort to the skin. Alcohol may also induce the inactivation of live vaccines. For these purposes, the practice of using boiled cotton swabs for immunization to clean up the injection site came into use. The use of boiled cotton swabs is the most common and preferred method for preparing the immunization site for injection[7].

In the Medical Officers' Immunization Handbook, Government of India, it is recommended that if the injection site is dirty then clean it with a clean water swab and administer the vaccine. Prior to administering injection, researchers from a few years have questioned the importance of skin preparation. A ground-breaking research carried out by Dann at a medical centre in which patients between 4 and 66 years of age received more than 5000 injections without skin preparation.No instances of infection have been reported, either systemic or local. Consequently it was concluded that infection from unsterilized skin could not be introduced through the needle. One of the researchers has performed another study in which best practice was checked for the WHO in relation to the prevention of injection related infection[8].

Swabbing of clean skin before injection was found to be unnecessary.Despite these results; there is a lack of research to create a solid evidence base for skin cleansing before an intramuscular injection is administered. The use of alcohol swabs is a standard procedure for skin preparation before injection in hospitals. Yet most of the organizations do not prescribe alcohol swabs for vaccination, and boiled swabs are used to prepare skin for immunization[9]. But WHO has stated not to use cotton balls stored in a multiuse jar, and it is also pointed out by PGIMER, Chandigarh's infection control committee.And no clearly clean skin should be swabbed before injection as recommended by WHO. The objective of the study was to compare the risk of local skin infection by preparing an injection site with boiled cotton swabs, alcohol swabs and no clearly clean skin swabbing for DPT / combination vaccines among infants at Advanced Paediatric Centre, PGIMER, Chandigarh[10].

Figure 1. Use of alcohol swab before and after injection

In the figure 1 it is shown that how the alcohol swab is used before and after the injection. This has shown first you have to clean the skin where you want to give the shot followed by the pinch and inserting the needle into the skin. After injecting the skin press an alcohol swab gently on the spot where the shot was given.

MATERIALS AND METHOD

An experimental design was adopted for evaluating the risk of infection at the injection site using the three methods of preparation of the injection site. The conditions for inclusion were infants who received DPT / combined vaccines.The research was carried out in the environment of Immunization, Advanced Paediatric Centre, PGIMER, and Chandigarh. There were three approaches used before DPT / combination vaccines to prepare the injection site.

Preparing site for injection using boiled cotton swabs, preparing site for injection using alcohol swabs, No clearly clean skin swabbing was observed.The research sample was collected from July-October 2014 using complete enumeration sampling technique. For the analysis the sample size was 450 samples (150 in each group). The allocation was per day randomization by node.The vaccine is carried out regularly, i.e. 6 days a week. Alternatively every protocol according to the randomization was implemented. The randomization numbers were created by computers and sealed in opaque envelopes.Before injection administration, the skin preparation methods were spread over the different days of the week.

The devices, i.e. interview schedule and observational checklist, and three protocols for skin preparation, were prepared from literature review and validated by nursing and pediatric experts.Checklist of findings contained multiple signs suggesting local skin infection. The checklist had contained a total of 15 symptoms. Symptom severity was measured after immunization according to adverse events,

and specific terminology requirements for adverse events.

Grade 1 infection means any sign of tenderness with or without warmth or edema or 100.4 ° F101.1 ° F or nodule or rash.Grade 2 infection means either of the symptoms-pain or edema or lymphadenopathy or reduced movement of the limbs or constant vomiting or fever 101.2- 102.0 ° F or cellulitis. Grade 3 infection indicates the occurrence of any of the 102.1- 104 ° F symptoms-abscess or fever.Inter-rater approach was used to test the reliability of the instruments. On the same subject two raters administered the same devices. The method has been tested on five subjects. The reliability of the inter rater was tested using the index Cohen Kappa. Kappa index was found to be accurate with 0.95.ANMs have been educated and trained in the application of three skin care methods procedural protocols.The parents were informed at first contact with the researcher about implementing the observational checklist to recognise the signs of infection at the injection site. The parents' statements have been checked by asking them to apply the observational checklist and record the symptoms by telephone.

The researcher then visited the house to test the reliability of observations from parents. Cohen Kappa has been measured for validity test. 60 random homes were visited and 55 agreements and 5 disputes were reached between the investigator and his kin. It was found that Cohen kappa is 0.913 which indicates good agreement with the p value < 0.001.The data were gathered in July-October; 2014. Parents / guardians of each study subject enrolled were given informed consent. The data was collected from the parent / guardian using the interview plan.During the time of vaccination their address and telephone numbers were obtained at first contact with parents. ANM administered the DPT / Combination Vaccine under the supervision of the Principal Investigator using the three protocols.

The checklist was used in post-procedural follow-ups from day 1 to day 7 to test for local skin infection, i.e. a week or before the parents subsided the infection.From the same day to the 7th day of vaccination or until the infection subsides, the parents were contacted by telephone, and were asked to follow the observational checklist and record the different symptoms contained in the observational checklist.Calculations were rendered using software SPSS 16.0. The data were analysed using statistics of concise and inferential type.Specific statistical methods were used such as central trend measurements, dispersion measurements, percentages and parametric tests i.e. ANOVA and repeated measure ANOVA and the results were interpreted and presented using tables, diagrams and graphs.

In the above dataset we have shown how the sample dataset pass through different steps, the randomization is applied and finally ANOVA test is perform to compute the results.

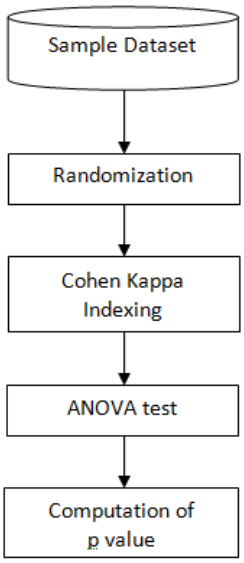

Figure 2. Block diagram of proposed work

RESULTS

The socio-demographic profile of infants is shown in Table 1. The subjects of the study had been distributed equally in each arm. Between the subjects of the boiled swab arm and alcohol swab arm most were below 4 months of age. 46 per cent of the research participants were below 2 months of age in the no swabbing arm as well as in the 2-4 month age range. All three of the arms had a higher proportion of males.The samples of the study were in the range of 1.93-8.17 kg with a mean weight of 4.58±1.323 in the boiled swab arm, 1.90-7.63 kg with a mean weight of 4.62±1.322 in the alcohol swab arm, and 2.10-7.95 kg with a mean weight of 4.83±1.353 in the no swab arm of the preparation of the injection site prior to injection.For age, gender and weight all three arms were homogeneous. (P value > 0.05 per chi square test).

Table1: Socio demographic profile of child. N= 450

Sample characteristics	Methods of injection site preparation before injection			X^2df p value
	Boiled Swab (n=150) n (%)*	Alcohol Swab (n=150) n (%) **	No Swabbing (n=150) n (%) ***	
Age of child (months)				
<3	75 (51.7)	71 (45.7)	68 (45.0)	5.145
3-6	68 (45.0)	70 (45.6)	698(45.0)	4
>5	6 (3.4)	11 (6.8)	132(8.1)	0.277
Sex				0.549
Male	90 (60.0)	95 (64.6)	95 (65.0)	2
Female	60 (40.0)	55 (38.4)	55 (35.0)	0.747

Weight of child (kg)				
<2.61	8 (5.3)	9 (6.1)	5 (3.4)	5.976
2.61-4.61	73 (48.7)	65 (45.0)	61 (41.0)	5
4.62-6.61	56 (37.3)	62 (41.7)	63 (42.3)	0.241
>6.62	13 (8.7)	15 (9.4)	24 (14.4)	

Age (months): Mean± SD (range) - * 1.96± 1.071 (1.12-8), **2.35 ± 1.148 (1.11-5.31), *** 2.14 ± 1.226 (1.20-6.10),
Weight (kg): Mean± SD (range) - * 4.68± 1.343 (1.94-8.18), **4.72 ± 1.332 (1.80-7.43), *** 4.43 ± 1.343 (2.20-7.85).

Socio Demographic Profile of Parents:

Most parents had been educated up to and above the secondary level. In most cases, in the three arms the mother's occupation was house wife and almost half of the fathers were professionals.The parent's mean income in the boiled swab arm was Rs.25007± 23835.91 with a range of Rs.4000-150000. While the income range in the second arm, (alcohol swab), was Rs.3000-1000000 with mean income Rs.20627± 19083.81.In no swabbing arm the parent's monthly income was in the Rs.3500-175000 range with mean income Rs.25207± 27727.36.All the classes were of a homogeneous type for parents' educational and occupational status and family monthly income (p value > 0.05 as per the chisquare test).Many of the research subjects in all three arms of the research were treated with pentavac and simple five. Half of the test participants in the three arms of the test obtained the 1st dose of vaccine.The results shows the homogeneity of all three classes for vaccine type given and vaccine dose (p value > 0.05 as per chi-square test).

Symptoms Reported by Parents Telephonically:

Nearly all the subjects of the study had fever on day of vaccination which was reduced to half on day 1. On the day of the vaccination only intermittent crying was present. Redness, tenderness, swelling occurred on the same vaccination day, and decreased on day 1.Very few (2.6 percent) subjects in the boiled swab arm had painless nodule formulation and resolved by 10th-25th day of vaccination. At the injection site, 2.0 percent of subjects in the alcohol swab arm had developed painless nodule and resolved it by the 15th -20th day of vaccination.Though 0.6 per cent of subjects in no swabbing category had painless nodule that was resolved after vaccination by 25th day.

Intensity Infection Among Subjects:

Table 2 compares infection severity among three preparation arms for the injection site. 4.6 per cent of subjects had no infection on the day of vaccination, 78.6 per cent had Grade 2 infection and 16.6 per cent had Grade 1 infection in the boiled swab arm.While 2.6% had no infection in alcohol swab neck, 27.3 had Grade 1 infection and 70.0% had Grade 2 infection.

Table 2: Intensity of infectionamong subjects. N=450

Days	Intensity of infection	Methods of injection site preparation before injection			χ^2 /Fisher Exact df p value
		Boiled swab (n=150) n (%)	Alcohol swab (n=150) n (%)	No swabbing (n=150) n (%)	
Day 1	No infection	7 (4.5)	4 (2.5)	6 (4.2)	4.676
	Grade 1	25 (15.5)	41 (2763)	32 (21.2)	2
	Grade 2	118 (78.5)	106 (70.0)	113 (74.4)	0.087
Day 2	No infection	58 (45.3)	76 (50.1)	63 (41.0)	3.741
	Grade 1	81 (54.0)	71 (46.3)	85 (56.3)	2
	Grade 2	1 (0.5)	4 (2.5)	1 (0.7)	0.165
Day 3	No infection	140 (93.3)	147 (91.3)	136 (91.5)	1.840
	Grade 1	10 (5.5)	12 (8.2)	13 (8.7)	2
	Grade 2	-----	1 (0.5)	----	0.413**
Day 4	No infection	145 (97.3)	145 (96.0)	148 (99.0)	1.129
	Grade 1	4 (2.5)	6 (4.2)	3 (2.2)	2
					0.677*
Day 5-8	No infection	145 (97.3)	147 (99.0)	148 (99.2)	1.770
	Grade 1	4 (2.5)	3 (2.1)	1 (0.7)	2
					0.547*

*Yates correction **Fisher Exact

4.0 per cent had no infection in either swabbing arm, 21.3 per cent had Grade 1 infection and 74.6 per cent had Grade 2 infection. Half of the subjects had no infection on the 1st day after vaccination and nearly all of the subjects had no infection among the three arms by the next day.On the 7th day, 8 subjects had painless nodule that was resolved 10-25 days later. There was no statistically significant difference between the three arms in the severity of the symptoms (p

value>0.05 as per chi-square test).

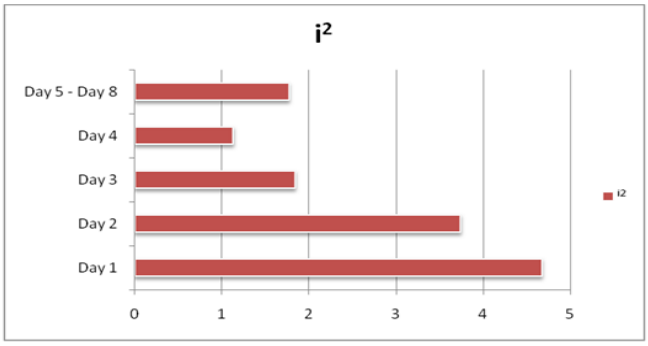

Figure 3. Comparison of i^2 value day wise

Figure 3 has shown the comparison of i2 value on the basis of days. Here we have take 5 days observation in which first four are the days from day 1 to day 4 and the last day is rest of the days from day 5.

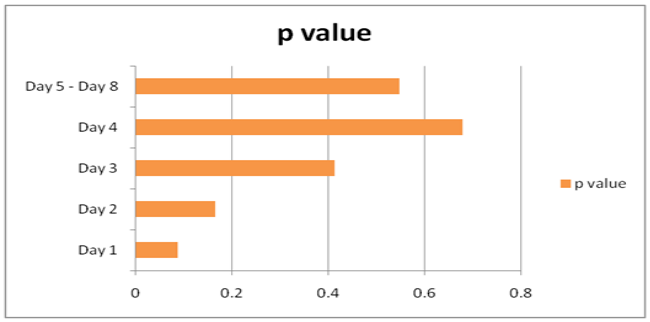

Figure 4. Comparison of p value day wise

Figure 4 has shown the comparison of p value on the basis of days. Here we have take 5 days observation in which first four are the days from day 1 to day 4 and the last day is rest of the days from day 5.

Comparison of Presence of Local Skin Infection after Vaccination between and within the arms:

Comparison of local skin infection after vaccination from day 0 to day 7 between the three arms i.e. boiled cotton swabs, alcohol swabs and no noticeably clean skin swabbing was performed and between the three arms.There was no statistically significant difference between and within the three arms in the presence of local skin infection after vaccination from day 0 to day 7 (p value > 0.05 as per ANOVA test).

Comparison of Presence of Local Skin Infection after Vaccination at Injection Site:

Table 3 shows a comparison of three of the arms boiled cotton swabs, alcohol swabs and no clearly clean skin swabbing for injection site preparation when infection occurs at the site of injection.Comparison of three research arms in pairs revealed that after vaccination between arms there is no statistically significant difference in local skin infection (p value>0.05 as per the Bonferroni and Dunnett T3 tests).

Table3: Comparison of presence of local infection after vaccination at injection site N= 460

(A) local infection at injection site	(B) local infection at injection site	Mean Difference (A-B)	p value*	94% Confidence Interval	
				Lower Bound	Upper Bound
Bonferroni					
Boiled cotton swabs	alcohol swabs	.012	1.02	-0.035	0.055
	no swabbing	.009	1.02	-0.037	0.054
Alcohol swabs	no swabbing	-.002	1.02	-0.047	0.043
Dunnett T3					
Boiled cotton swabs	alcohol swabs	.011	0.95	-0.038	0.058
	no swabbing	.009	0.96	-0.034	0.054
Alcohol swabs	no swabbing	-.002	1.02	-0.045	0.044

*Repeated measure ANOVA

Management of Fever and Care of Injection site:

Almost all of the study subjects were administered antipyretics in the three arms as stated by the parents. More than 3 doses were given in boiled swab arm 43.1 per cent. Although more than 3 doses were given in alcohol swab arm and 44.5 percent in no swab arm, 37.4 percent were administered.Most participants in the sample were administered antipyretics in the three arms for two days. There was no important statistical difference between the three arms for number of antipyretic doses and number of days of antipyretic administration (p value > 0.05 as per chisquare test).

On the injection site, few subjects applied ice (7.3 percent) to relieve tenderness and discomfort in all three divisions of the study and 2.0 percent of subjects applied Vicks only in boiled swab arm. Among the three research weapons, the application was made for 2 days.There was no statistically significant difference in injection site treatment between the three arms (p value>0.05 as per chisquare test).

DISCUSSION

Injections are the most common procedures performed by nurses worldwide. It is important to keep it safe when delivering this form of injection, i.e. it should not affect the patient and the health care provider.In an attempt to keep the injections safe, the idea of planning for the injection site came into practice to employ control of infections.There are numerous guidelines followed by different health care

agencies leaving nurses in an unclear position as to whether or not to clean the skin. In fact, there is a lack of evidence to show that whether swabbing or no swabbing at the injection site can lead to any infection.The present study was therefore conducted with the aim of comparing the risk of local skin infection with boiled cotton swabs, alcohol swabs and no visibly clean skin swabbing for DPT / combination vaccines among infants by preparing the injection site.

Although there are guidelines for delivering the injections, each health care provider always practices what they are comfortable with. Thus, three separate guidelines for the three methods of skin preparation were established to ensure the uniformity in administering the vaccine.The ANM's have been educated and trained to apply the three procedural protocols. Re-demonstrations were held to ensure the protocols were implemented correctly.Parents are the best observers for earliest identification of any changes in their infant. So the parents were informed at first contact about applying the observational checklist to recognise the signs of the infection and their hypothesis was confirmed.

The follow-up was performed by phone to assess the signs of the infection using the parent's observational checklist. There are previous research that demonstrate the efficacy of telephone follow-up. The efficacy of telephone follow-up to predict the community's risk of orthopaedic surgical site infection has been assessed and a successful method of detecting infection was identified after hospital discharge.

CONCLUSION

The study indicates that there is no statistically significant difference in the initiation of injection site infection in three site preparation classes, i.e. boiled cotton swab, alcohol swabs and no clearly clean skin swabbing prior to injection.The idea underlying skin preparation before injection by wiping it with an alcohol swab as an antiseptic measure to prevent infection was critically examined in this study and it was found that the widely used technique was ineffective as a safeguard against infection.The study also showed that although the skin swabbing before injection significantly decreased the number of bacteria (skin flora), there was no significant difference between clinical signs and adverse local or systemic effects before intramuscular, intradermal and subcutaneous injections with or without alcohol swab preparation.

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