Comparative Evaluation

Comparative Efficacy and Tolerability of Oxum against Povidone Iodine Topical Application in the Post-caesarean Section Wound Management

Ashok Anand, *Department of Obstetrics & Gynaecology,*

Grant Medical College & Sir J. J. Group of Hospitals, Byculla, Mumbai - 400 008.

Introduction

Caesarean section is one of the oldest surgeries done in obstetric practice even older than hernia or hysterectomy.

The incidence of Caesarean section has dramatically increased in modern medicine and is attributable to many maternal and foetal factors.

Women are almost three times more likely to have a caesarean birth now than they were twenty years ago. This rise is attributable to many factors, not only the vastly improved safety of the operation itself and of anaesthetic techniques but includes also the fear of litigation[1].

In a prospective study conducted by Anuradha Kumar *et al*, from Sept. 1993 to May 1994, the incidence of primary CS was 14.8% out of 1418 deliveries[2], of which 15.8% of patients had an elective and 84.2% had an emergency CS.

Kamala Jay Ram V. in a study reported, of 16782 deliveries in five years the CS rate was 16% because of associated risk factors and late referrals. 62.75% was primary CS and 37.25% was repeat CS. Among the primary CS 91.4% were emergencies and 8.6% were elective[3].

Korst M. L. *et al* from California reported primary CS rate of 25%[4]. Nielsen T.F. *et al* estimated prospectively in 1319 patients that those undergoing CS were 18% of all deliveries[5].

Wound infections are a common complication of surgery that add significantly to the morbidity of patients and cost of treatment. The global trend towards reducing the length of hospital stay post-surgery and the increase in day case surgery means that surgical site infections (SSI) will increasingly occur after hospital discharge[6].

The incidence of abdominal incisional infections following caesarean delivery ranged from 3% to 15% with an average of 6% during caesarean section delivery. The post-operative complication rate was 24.3%. 18.5% of the patients had febrile morbidity and 10.9% had non-febrile morbidity[7].

A retrospective cohort study was conducted by E. Henderson *et al*, the overall infection rates were 42.1% and 46.1% for women delivered by primary and secondary CS respectively, incision surgical wound infection accounted for the largest proportion of post-caesarean infection. All types of post-caesarean infection, except asymptomatic bacteria, caused the duration of the post-partum hospital stay to be significantly long[8].

T. Parrot *et al* conducted a prospective study, 31.5% patients developed infections. There was no significant difference in infection rate between elective and emergency procedure. 4% developed endometritis; wound infection was found 11.3% and 14.5% developed a post-operative UTI[9].

P. A. Hawrylyshyn *et al* compared a retrospective study by means of multi-variant discriminate analysis, the infection rates of endometritis depend on the type of delivery, the rates were vaginal: 3.6%; elective repeat CS: 6.0%; non-urgent primary caesarean section: 22.2%; and emergency CS: 38.4%[10].

One study done by S. A. Rasmussen *et al*, found that 29.3% of women suffered one or more complications (8.5% intraoperative, 23.1% post-operative); the most common complication was infection (22.3%)[11].

Guldholt *et al*, compared frequency of febrile morbidity between planned and emergency CS (20.9% vs 77%)[12].

A proper post-surgical wound care thus becomes an extremely important factor in preventing the occurrence of infection. An effective wound care product should address the most important aspects of infection control and safety. If infection is present in the wound, standard treatment includes cleansing and either surgical or mechanical debridement and sometimes oral or intravenous antibiotics.

An ideal wound care product in addition to controlling the infection should also protect the normal tissues and not interfere with the normal wound healing.

Povidone iodine is the most commonly used topical wound care product in practice. Although effective in killing a wide range of bacteria and viruses, it tends to kill human cells, destroying tissue and interfering with the wound healing process.

Microcyn (a superoxidized, non toxic, non-irrigating, no rinse dermal wound irrigant) solution is used in humans for wound care treatment including postoperative (post-surgical) wound care.

Microcyn Superoxidized solution is a super-oxidized solution with neutral pH and a longer shelf life (>12 months) than any other Superoxidized solution so far tested. In addition, Microcyn Superoxidized solution is manufactured using validated processes and equipment, in accordance with cGMP and ISO standards.

The known chemical species present are: hypochlorous acid, sodium hypochlorite, chlorine dioxide, ozone, hydrogen peroxide, sodium hydroxide, sodium chloride. Microcyn Superoxidized solution is a hypotonic solution with an osmolarity of 13 mOsm/Kg.

Microcyn Solution is ready for use with no mixing or dilution required. It can be used as a comprehensive therapy, as a moistening, irrigation and debridement solution. It should be applied directly to the affected area by immersion, pouring, pressure jetting or via saturated gauze or dressing as follows: immersed up to 15 minutes, daily during initial treatment, soaked/sprayed at each dressing change, as and when required.

Several studies have reported excellent efficacy and safety of Microcyn in wound care. Microcyn induces wound healing by reducing the microbial load in wounds. It acts on a range of microorganisms like bacteria, viruses and fungi. Results from pilot clinical studies suggest that wounds treated with Microcyn Superoxidized solution develop granulation tissues earlier in comparison to lesions treated with other products.

Objective

The present post-marketing (user experience) study was conducted to compare the efficacy and tolerability of Oxum (Microcyn Superoxidized solution) with Povidone iodine topical application in the management of wounds in post-caesarean section.

Material and Methods

Sample Size

The study was conducted in a total of 50 patients with 25 patients in each Group viz. Group A (Oxum) and Group B (Povidone Iodine).

Investigational Product

Test Product: Oxum. (Group A)

Reference Product: Povidone Iodine. (Group B)

Procedure

Patients were recruited for the study, after studying the inclusion and exclusion criteria. The informed consent was taken in all patients.

Post-caesarean wounds were assessed and were managed with Oxum dressings (twice a day) in Group A and with Povidone iodine application in Group B. The efficacy evaluation was based on appearance, presence or absence of odour, discharge, necrotic tissue, granulation tissue at the site of the wound. The patients were also assessed based on the symptoms such as pain, edema, redness, dryness and itching. The wounds were treated for 10 days. The assessments were made on the days 5 and 10. Primary outcome measures included complete healing, partial healing and non-healing on the days 5 and 10.

Doctor evaluated global efficacy and patients evaluated global tolerability.

Adverse events were reported in the appropriate sections of the CRF.

The collected data was analysed and interpreted using appropriate statistical tests.

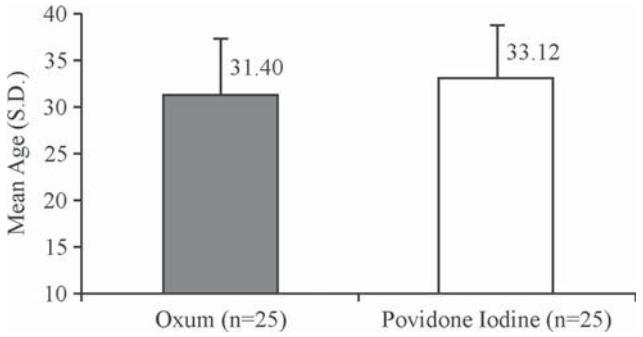
Results

The study was conducted in 50 patients {25 patients in each Group viz.: Oxum (Group A) and Povidone Iodine (Group B) Group}. The demographic characteristics of the two Groups are as given in **Table 1**.

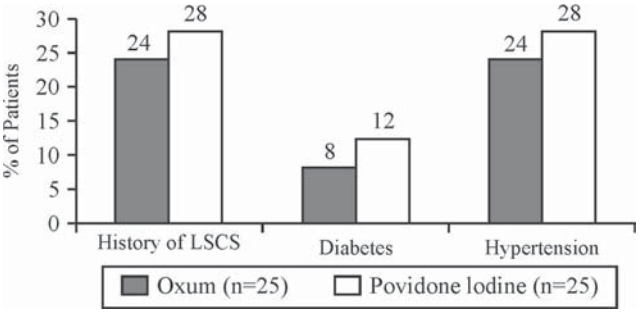
The average age of patients in Group A was 31.40+ 5.88 whereas the corresponding age in Group B was 33.12 + 5.86 (**Graph 1**).

Medical history (**Table 1**, **Graph 2**) of the enrolled patients signifies that 6 (24%) patients in Group A and 7 (28%) patients in Group B had a history of previous LSCS,

Graph 1
Age (years) of Patients Enrolled



Graph 2
Baseline data of patients enrolled (% of Patients)



whereas 2 (8%) patients in Group A and 3 (12%) in Group B had a history of diabetes. Similarly, 6 (24%) patients in Group A and 7 (28%) in Group B had a history of hypertension. Overall, both the Groups were matched well and there was no significant difference between the two Groups.

Table 2 shows the details of surgical wound assessments in both the Groups. Two (8%) patients in Group A and 3 (12%) patients in Group B had an unhealthy wound appearance on day 5, whereas on day 10, none of the patients in Group A but 1 (4%) patient in Group B showed unhealthy wound appearance (**Graph 3**). Two (8%) in Group A and 3 (12%) in Group B had foul odour on day 5. On day 10 none of the patients in Group A had foul odour; however, one patient in Group B had foul odour (**Graph 4**). Similarly, 2 (8%) patients in each Group had bleeding wounds on day 5 but none of the patients had a bleeding wound on day 10 (**Graph 5**). Two patients in each Group had purulent discharge on day 5, whereas none of the patients in each Group had a discharge on day 10 (**Graph 6**). Two

Table 1
Demographic data of the patients enrolled

	Oxum (n=25)	Povidone Iodine (n=25)	'p'
Age (yrs.)*	31.40 (5.88)	33.12 (5.86)	>0.05 (t-test)
History of Previous LSCS #	6 (24%)	7 (28%)	>0.05 (Chi-sq. test)
Diabetes #	2 (8%)	3 (12%)	>0.05 (Chi-sq. test)
Hypertension #	6 (24%)	7 (28%)	>0.05 (Chi-sq. test)

* Mean (S.D.), # No. (%)

Table-2
Surgical wound (signs) assessment #

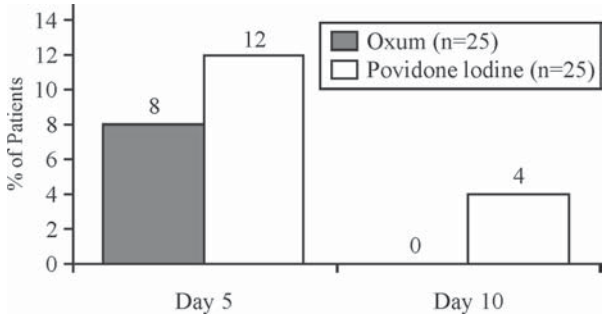
	Oxum (n=25)	Povidone Iodine (n=25)	'p' (Chi-Square test)
Unhealthy Appearance			
• Day 5	2 (8)	3 (12)	>0.05
• Day 10	0 (0)	1 (4)	
Odour			
• Day 5	2 (8)	3 (12)	>0.05
• Day 10	0 (0)	1 (4)	
Bleeding			
• Day 5	2 (8)	2 (8)	—
• Day 10	0 (0)	0 (0)	
Any Other Discharge			
• Day 5	2 (8)	2 (8)	—
• Day 10	0 (0)	0 (0)	
Indolent stitches			
• Day 5	2 (8)	4 (16)	>0.05
• Day 10	0 (0)	0 (0)	
Necrotic/ fibrotic Tissue			
• Day 5	0 (0)	0 (0)	—
• Day 10	0 (0)	0 (0)	
Granulation Tissue			
• Day 5	22 (88)	20 (80)	>0.05
• Day 10	25 (100)	25 (100)	

No. (%)

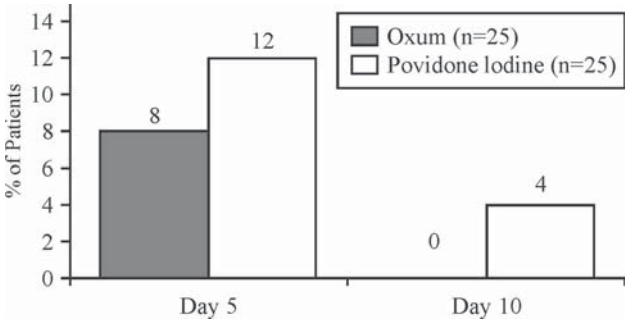
patients in Group A (8%) and 4 (16%) patients in Group B had indolent stitches on day 5 which were healed on day 10 (**Graph 7**). None of the patients in both the Groups had a necrotic or fibrotic tissue on day 5 and day 10. On day 5, 22 (88%) patients in Group A and 20 (80%) patients showed granulation tissue on day 5, whereas all the patients in both the Groups had granulation tissue on day 10 (**Graph 8**).

Surgical wound symptom assessment is as shown in **Table 3**. Only one patient (4%) in Group A and 3 (12%) patients in Group B had pain at surgical site on day 5, whereas none of the patients had pain at surgical site wounds on day 10 (**Graph 9**). One patient in Group A and 3 patients in

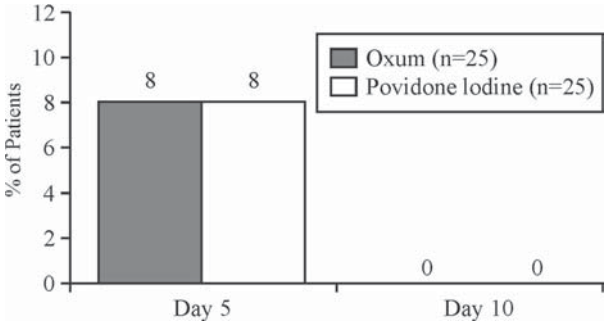
Graph 3
Unhealthy Appearance of Surgical Wound (% of Patients)



Graph 4
Foul Odour of Surgical Wound (% of Patients)



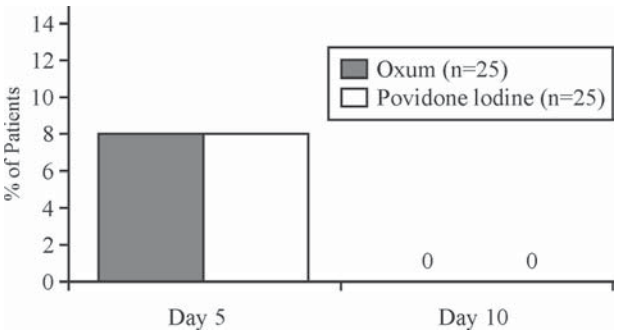
Graph 5
Bleeding at Surgical Wound (% of Patients)



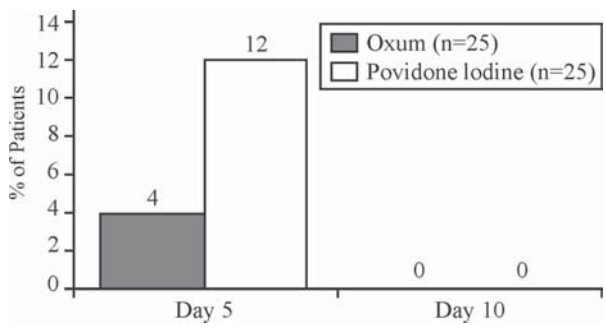
Group B had redness at surgical site wound on day 5 but it disappeared in all the patients on day 10 (**Graph 10**). 2 patients in Group B had edema near the surgical site wound on day 5 which subsided on day 10 (**Graph 11**).

Dryness in the area of wound was observed in 100% patients in both the Groups on day 5 (**Graph 12**).

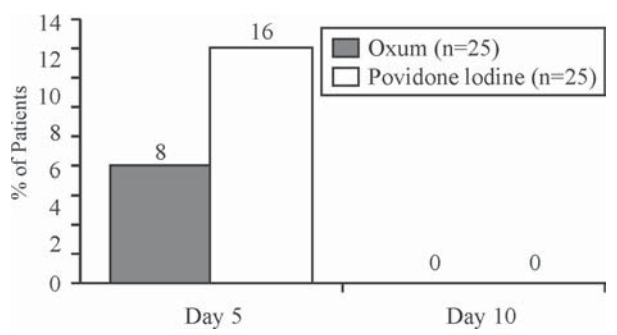
Graph 6
Discharge at Surgical Wound (% of Patients)



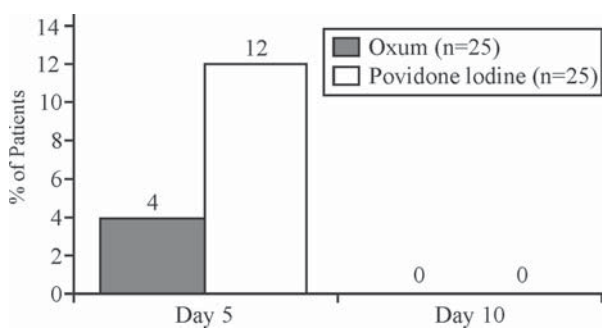
Graph 9
Pain at Surgical Wound (% of Patients)



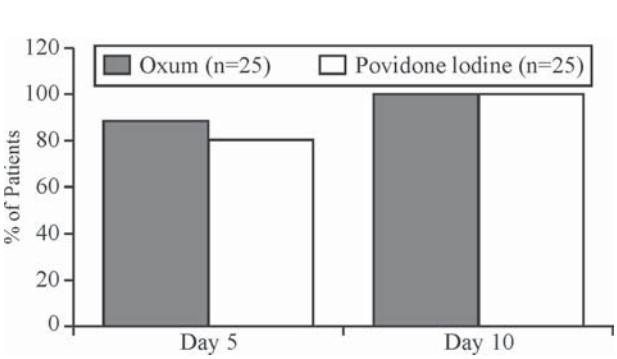
Graph 7
Indolent Stitches at Surgical Wound (% of Patients)



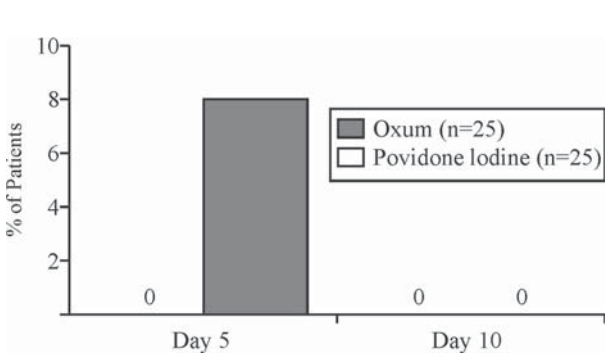
Graph 10
Redness at Surgical Wound (% of Patients)



Graph 8
Granulation tissue at Surgical Wound (% of Patients)



Graph 11
Edema at Surgical Wound (% of Patients)



None of the patients had itching sensation near the area of wound.

As shown in **Table 4**, all the patients (100%) in both the Groups had partially healed surgical wounds on day 5 whereas on day 10, 24 (96%) patients in Group A and 22(88%) patients in Group B were completely healed (**Graph 13**).

No adverse events were reported in this study.

Table 5 reveals the global efficacy and safety evaluation of patients in both the Groups. As shown in the table,

Graph 12
Dryness at Surgical Wound (% of Patients)

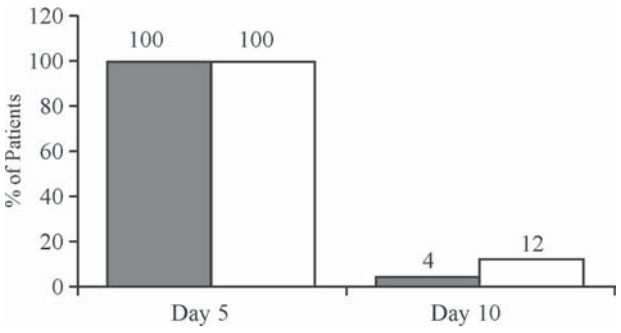


Table 3
Surgical wound (symptoms) assessment #

	Oxum (n=25)	Povidone Iodine (n=25)	'p' (Chi-Square test)
Pain			
• Day 5	1 (4)	3 (12)	>0.05
• Day 10	0 (0)	0 (0)	
Redness			
• Day 5	1 (4)	3 (12)	>0.05
• Day 10	0 (0)	0 (0)	
Edema			
• Day 5	0 (0)	2 (8)	>0.05
• Day 10	0 (0)	0 (0)	
Dryness			
• Day 5	25 (100)	25 (100)	>0.05
• Day 10	1 (4)	3 (12)	
Itching			
• Day 5	0 (0)	0 (0)	—
• Day 10	0 (0)	0 (0)	

No. (%)

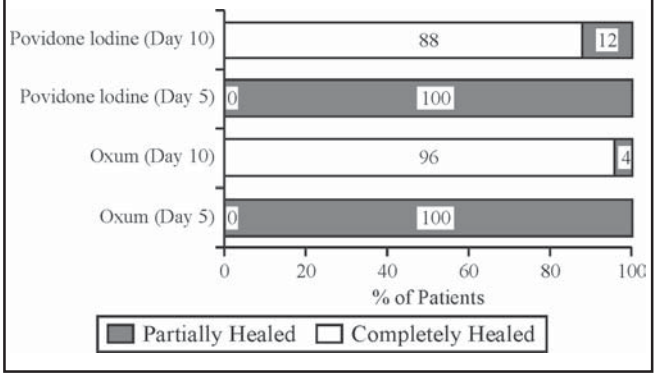
surgeons reported excellent efficacy of the treatment in 10 out of 25 (40%) patients in Group A. The corresponding value in Group B was 9 (36%) patients. Nine (36%) patients in Group A and 6 (24%) patients in Group B were reported to experience good efficacy of the treatment. A moderate efficacy was reported by the surgeon for 5(20%) patients in Group A and 7 (28%) patients in Group B. Only one

Table-4
Clinical Outcome#

	Oxum (n=25)	Povidone Iodine (n=25)	'p' (Chi-Square test)
Partially Healed			
• Day 5	25 (100)	25 (100)	—
• Day 10	1 (4)	3 (12)	
Completely Healed			
• Day 5	0 (0)	0 (0)	>0.05
• Day 10	24 (96)	22 (88)	
No Healing (Infected)			
• Day 5	0 (0)	0 (0)	—
• Day 10	0 (0)	0 (0)	

No. (%)

Graph 13
Healing of Surgical Wound (% of Patients)



Graph 14
Global Efficacy at end of study (% of Patients)

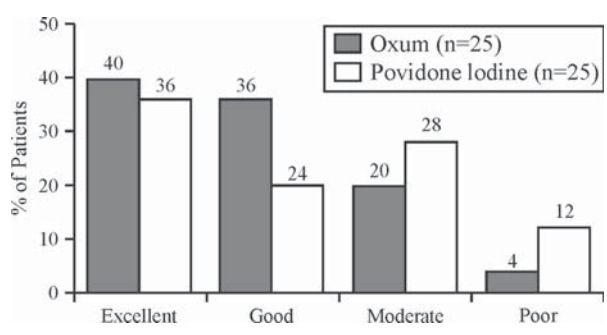
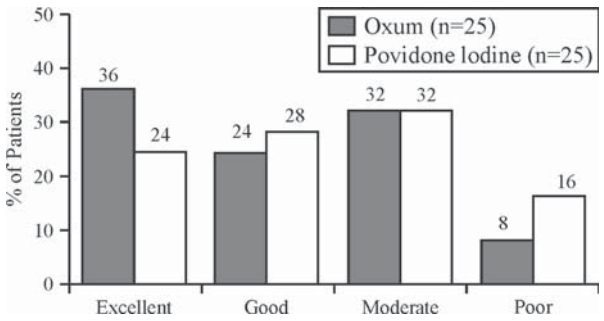


Table 5
Global Efficacy & Safety Evaluation #

	Oxum (n=25)	Povidone Iodine (n=25)	'p' (Chi-Square test)
Efficacy by Surgeon			
• Excellent	10 (40)	9 (36)	<0.05
• Good	9 (36)	6 (24)	
• Moderate	5 (20)	7 (28)	
• Poor	1 (4)	3 (12)	
Safety by Patient			
• Excellent	9 (36)	6 (24)	<0.05
• Good	6 (24)	7 (28)	
• Moderate	8 (32)	8 (32)	
• Poor	2 (8)	4 (16)	

No. (%)

Graph 15
Global Safety at end of study (% of Patients)



(4%) patient in Group A and 4 (12%) patients in Group B were reported by surgeons to have poor response to the treatment (**Graph 14**).

Global safety evaluation indicates that excellent safety was reported by 9 (36%) patients in Group A and 6 (24%) patients in Group B. Six (24%) patients in Group A and 7 (28%) patients in Group B reported good safety profile of the treatment. Eight patients (32%) in both the Groups reported moderate safety profile of the treatment. Only 2 patients in Group A (8%) and 4 patients in Group B (16%) reported poor safety profile of the drug (**Graph 15**).

Discussion

Caesarean section delivery has become extremely common in developing countries including India. C-Section today is one of the most commonly performed surgeries. As a result, post-operative wound care in caesarean is also very important to avoid complications arising from C-section.

Superoxidized solutions have been proved safe and effective in post-surgical wound management. In this study, Oxum was tested against Povidone iodine for efficacy and tolerability in the management of post-caesarean wound care.

A total of 50 patients (25 in each Group) who had undergone the caesarean section were enrolled in this study. As seen from the results, both the Groups were similar and there was no significant difference between the two Groups in terms of demographic characters and medical history.

Surgical wound signs assessment showed that the wound healing at the end of the study were similar in both the Groups, when the parameters, such as presence of granulation tissue, presence of necrotic tissue were considered. Surgical wound signs and symptoms assessment indicate that relatively more proportion of patients in Oxum treated Group showed healing on day 5 compared to Povidone-iodine treated Group.

All the patients (100%) in both the Groups had partially healed surgical wounds on day 5, whereas on day 10, 24 patients (96%) in Oxum Group and 22 patients (88%) in Povidone-iodine Group were completely healed.

Similarly, the global efficacy evaluation also confirms the superiority of Oxum (Microcyn Superoxidized solution) over Povidone iodine as good to excellent efficacy response was recorded in relatively more number of patients in Oxum treated Group as compared to Povidone-iodine treated Group.

These findings are supported by the findings of Dalla Paola[14] *et al* in a comparative study of Microcyn Superoxidized solution against Povidone iodine in the management of diabetic foot ulcer.

Wolvos TA [15] used Microcyn Superoxidized solution to treat 26 patients with various wound types that included 9 patients with post-operative wound. In these patients, the

wounds including those with complications healed completely with dressings of wound with Microcyn Superoxidized solution. He concluded that Microcyn Superoxidized solution could be used to treat a variety of wounds from simple to extremely complex. It can be used as the wound irrigation solution at simple dressing changes, and it can serve as the solution to moisten the gauze used to dress the wound.

Gutierrez AA[16] in his study to explore various applications of Microcyn Superoxidized solution concluded that the moistening effect and the minimum toxicity found with the use of this superoxidized solution makes it a good choice for wound care management and that this non-antibiotic technology appears to offer a broad new paradigm for the prevention and treatment of acute and chronic wounds.

Conclusion

Oxum (Microcyn Superoxidized solution) is safe and effective in post-caesarean wound care management and gives better efficacy and faster response as compared to the traditional Povidone-iodine topical application in post caesarean section wound care management.

References

1. Dickinson J.E. — "CaesareanSection" In: D.K.James, P.J.Steer, C.P.Weiner. HighRisk Pregnancy Management options. 2nd Ed Saunders, 1217- 1244, 1999.
2. Kumar Anuradha, Thakur Sita, Preme H.K, Gupta K.B. — "Maternal complications in caesarean section deliveries" *J.Obstet. Gynecol. of India*. **20**: 36-40, 1996.
3. Kamala Jayaram V. — "Caesarean section- 5year analysis "*J. Obstet. Gynecol. India*. **47**: 57-59, 1996.
4. Korst M.L., Gregory K.D., Gornbein J.A. — "Elective primary caesarean delivery: accuracy of administrative data". *Paediatr.Perinat.Epidemiol*. **18**(2):112-(9), 2004.
5. Nielsen T.F., Hokegard K.H. — "Postoperative cesarean section morbidity: a prospective study" *Am. J. Obstet. Gynecol*. **146** (8): 911-5, 1983.
6. Petherick Emily S., Dalton Jane E, Moore Peter J and Cullum Nicky. — *BMC Infectious Diseases* 2006, **6**:170 doi:10.1186/1471-2334-6-170.
7. Cunningham F.G., Ghant N., Leveno K. — "Caesarean delivery and post partum hysterectomy" Williams Obstetrics.21st Ed. Mc Graw Hill.2001; 537-553.
8. Henderson E., Love J. E. — "Incidence of hospital – acquired infections associated with caesarean section". *J.Hosp.Infec*. 29(4):245-55, 1995.
9. Parrott T., Evans A.J., Lowes A. — "Infection following caesarean section". *J.Hosp.Infect*. **13**(4):349-354, 1989.
10. Hawrylyshyn P.A., Bernstein P., Pepsin F.R. — "Risk factors associated with infection following cesarean section". *Am. J. Obstet. Gynecol.* **139** (3): 294-298, 1981.
11. Rasmussen S.A., Maltau J.M. — "Complications following cesarean section". *Tidsskr Nor Laegeforen.* **110**(3):351-3, 1990.
12. Guldholt I., Espersen T. — "Maternal febrile morbidity after cesarean section". *Acta Obstet. Gynecol. Scand*. **66**(8): 675-9, 1987.
13. Oxum Product Monograph.
14. Dalla Paola L., Brocco E., Senesi A., *et al*. — Use of Dermacyn, a new antiseptic agent for the local treatment of diabetic foot ulcers. *Journal of Wound Healing*. **2**:201, 2005.
15. Wolvos Tom A. — A look at how combination therapy can optimize wound healing in *Clinical Experience With A New And Stable Super-Oxidized Water In Wound Treatment, Advanced Wound Care with Stable, Superoxidized Water.* Supplemet to January 2006 Wounds (A Compendium Of Clinical Research And Practice) Page 11-13.
16. Gutiérrez Andrés A. — The Science Behind Stable, Super-Oxidized Water Exploring the various applications of super-oxidized solutions in *Clinical Experience With A New And Stable Superoxidized Water In Wound Treatment, Advanced Wound Care with Stable, Superoxidized Water,* Supplemet to January 2006 Wounds (A Compendium Of Clinical Research And Practice) Page 7-10.