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*Full Length Research Paper*

# Is Ultrasound Gel Harboring Any Bacterial Growth?

***Hanadi Abdulqader Jasim, Hassan Ala ' Faried and Mohammed Basim Majeed**

Department of Microbiology, College of Medicine, Basra University, Iraq

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**The ability of Ultrasound Gel to be a source for infections has been exhibited a big problem in healthcare environments. The aim of this study was to recognize bacterial species that contaminate ultrasound gel. A total of 56 Ultrasound Gel samples were collected from hospitals and private clinics. Many bacterial species have been determined (25%) of total samples. The large part of bacteria which were recorded includes those that have a role in skin infections and other underlying tissues. *Staph.aureus, Pseudomonas, Klebsiella, Enterobacter* and *Bukholderia* had been contaminated ultrasound gels in various degrees. Besides that, sealed and opened gel containers also revealed bacterial growth. Hence, all attempts should be made to limit the possibility of contamination.**

**Keywords:** Bacterial Growth, Ultrasound Gel Harboring.

## INTRODUCTION

The diagnostic clinical procedures and physical examination need many tools that help confirmation the clinical state of patients. One of these tools is Ultrasonography and endoscopy which mediated by using an Ultrasound gel as a conductive medium by placing it on the patient's skin at the beginning of the ultrasound examination or therapy [1].

Infections that occur in hospitals exhibit a common issue in a healthcare environment, and annually a considerable and big number of patients gaining such infection. Researchers had been shown the capacity of ultrasound gel to be a source of infection in impaired immune persons. [2]

Keizur et al (1993) described an outbreak of Burkholderia cepacia urinary tract infections that was traced to contaminate ultrasound gel used for transrectal prostate biopsy. [3]

There are many sources for ultrasound gel which derives in various dispenser sizes and formulations, often without clearly defined differences between products or suggested uses. [4] Although gels are often considered bacteriostatic because of methyl benzoate or parabens, one research revealed that there is no antimicrobial activity in ultrasound gel and could function as a medium for bacterial growth [5]. Various bacterial species such as Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa were pretended to exist inside ultrasound gel [6].

Although bottle of ultrasound gel is not marked as sterile or not. Its contamination during production and packaging should be realized to be one source of nosocomial infections. Investigation by Ultrasound procedures have been involved as potential vectors for the transmission of bacterial pathogens In all instances, it was assumed that the gel had become contaminated while in use. [2, 5].

*Corresponding Author's Email: hind_iraq2006@yahoo.com

Studies have shown many ways in which gels lead to infection [2]. For example: not cleaning refillable bottles, warming the gels in uncapped containers for prolonged periods of time, and utilizing non sterile gels marked for external use only during invasive procedures (such as biopsies) or on mucous membranes [7,8]. Many bacterial species were isolated in the ultrasound gel which became contaminated by them such as ***Klebsiella oxytoca,*** [9]. ***Staph.aureus*** and ***Pseudomonas aeruginosa*** Also isolates of ***Burkholderia spp*** had been found in 73% of the gel bottles which were contaminated by this organism as the most repeated bacteria [10].

This study was aimed to determine the level of contamination of ultrasound gel by isolation and identification of bacteria harboring both sealed and opened gel bottles from hospitals and private clinics.

## MATERIALS AND METHODS

### •Sampling

Fifty-six samples of Ultrasonic gel (USG) were collected from sealed and opened gel bottles by sterile swabs. The USG were chosen randomly and comprised Hospitals and Private Clinics of Basra city center during March to April, 2014.

After collection, the swabs were transmitted to the laboratory of microbiology department in Basra medical college and streaked immediately on the various culture media (Mannitol Salt Agar, MacConkeys Agar, Blood Agar and Nutrient Agar plates) (Himedia) then incubated at 37ºC for 24–48h.

From each plate showing bacterial growth, colonies stained by the Gram method. Isolates were submitted to further identification by colonial morphology, catalase, oxidase and different biochemical reactions. [11, 12]

### •Statistical Analysis:

SPSS (Statistical Package for Social Sciences - Version 20) computer file was used for statistical analysis.

## RESULTS

Out of 56 USG samples that examined, 14 (25%) showed bacterial growth while 42 (75%) appeared with no growth (P< 0.01). USG samples from hospitals revealed the bacterial growth in 50%, differently from private clinics samples that shown 15% (Table-1, Figure-1).

In this study bacterial growth demonstrated various types as shown in (Table - 2 and Figure - 2). Out of 20 bacterial species Gram positive and Gram negative bacteria appeared equally (10 types for each group)

It has been found that ***Pseudomonas spp.*** exhibited higher percentage (35.71%) of positive growth followed by ***Staph. aureus, Staph. epidermides, Klebsiella spp., Burkholderia spp.*** (28.57 %, 21.43 %, 14.29 % and 14.29 %) respectively. Also ***Micrococci***, ***Diphtheroids***, ***Bacillus subtilus*** and ***Enterobacter spp.*** revealed equally (7.14%).

Ultrasound gel samples of private clinics demonstrated various bacterial species. Isolates of ***Pseudomonas spp***. appeared higher than other bacterial types (30%) followed by ***Staph. aureus, Klebsiella spp., Staph. epidermides, Diphtheroids*** and ***Enterobacters***(20%,20 %, 10 %, 10 % and 10%) respectively as shown in (Table3 and Figure3).

On the other hand, USG samples from hospitals had been shown ***Pseudomonas spp., Staph aureus***, ***Burkholderia spp***., and ***Staph epidermides*** equally (20%) (Table-4, Figure-4).

In relation to Gram Stain method, this study found that Gram negative bacteria (60%) revealed higher than Gram positive (40%) in USG samples from private clinics. While USG samples from hospitals showed Gram positive bacteria (60 %) higher than Gram negative bacteria (40) (Figure5 &6)

Occurrence of bacterial contaminations also revealed differences in their frequencies in both opened and sealed containers of USG as shown in (table -5 and 6). The bacterial growth appeared in both sealed and opened containers (16.67 %, 28.95 %) respectively.

## DISCUSSION

Hospital – acquired or nosocomial infections occur when patients entering to the hospitals [13]. Many medical devices including stethoscopes, electronic thermometers and bronchoscopes have all been previously implicated in the transmission of nosocomial infections [2, 11]. Recently warn has involved that the gels may lead to infection [2]. Contamination of ultrasound gel can be occurred with different pathogenic organisms [4, 6].

This study answers the question for probability of harboring Ultrasound Gel any bacterial growth. Surprisingly our result revealed that there is a significance appearance for bacterial growth in USG samples from both private clinics and hospitals.

Best to our knowledge that this study is the first one in locality that shed light on the various types of bacteria that contaminated USG samples.

The bacterial growth appeared in 25% of 56 samples of USG and in 50% of that taken from hospitals while 15% of Private clinics gel samples showed bacterial growth. The reason for this results may be referred to the contamination of Ultrasound Gels during production and/or packaging and may serve as a source of nosocomial infection since there is no labeling as either sterile or non-sterile [2] and actually

**Table 1:** occurrence of positive bacterial growth among USG samples

| Source | Bacterial growth | | Total |
|---|---|---|---|
| | + ve | – ve | |
| Hospital | 8 (50 %) | 8 (50 %) | 16 (28.57 %) |
| Private Clinic | 6 (15 %) | 34 (85 %) | 40 (71.43 %) |
| Total | 14 (25 %) | 42 (75 %) | 56 (100 %) |
| | $X^2$ = 7.467 **P value** = 0.006 | | **df** = 1 |

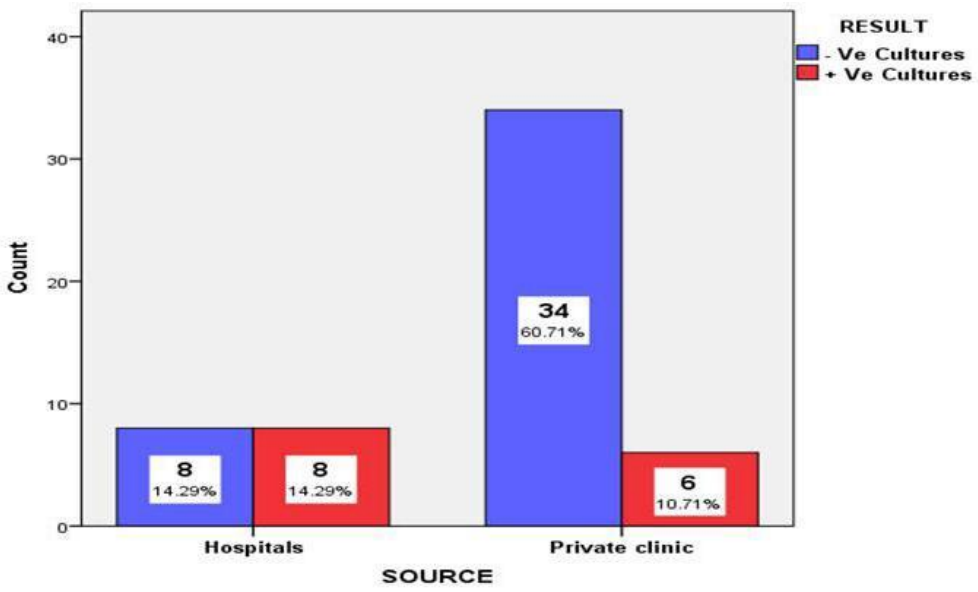


**Figure 1:** Occurrence of positive bacterial growth among USG samples

**Table 2:** Frequency of ba cterial species of USG sample

| Types of bacteriia | NO. | (%) from + ve isolates (N=20) | (%) from + ve growth (N=14) | (%) fromm totall |
|---|---|---|---|---|
| **Gram +ve bacte ria** | **10** | | | |
| *Staph. aureus* | 4 | 20 % | 28.57 % | 7.14%% |
| *Staph. epidermiddis* | 3 | 15 % | 21.42 % | 5.36%% |
| *Micrococci* | 1 | 5 % | 7.14 % | 1.79%% |
| *Diphtheroids* | 1 | 5 % | 7.14 % | 1.79%% |
| *Bacillus subtilu s* | 1 | 5 % | 7.14 % | 1.79%% |
| **Gram - ve bacte ria** | **10** | | | |
| *Pseudomonas sppp* | 5 | 25 % | 35.71 % | 8.93%% |
| *Klebsiella spp* | 2 | 10 % | 14.28 % | 3.57%% |
| *Enterobacter* | 1 | 5 % | 7.14 % | 1.79%% |
| *Burkholderia sppp* | 2 | 10 % | 14.28 % | 3.57%% |

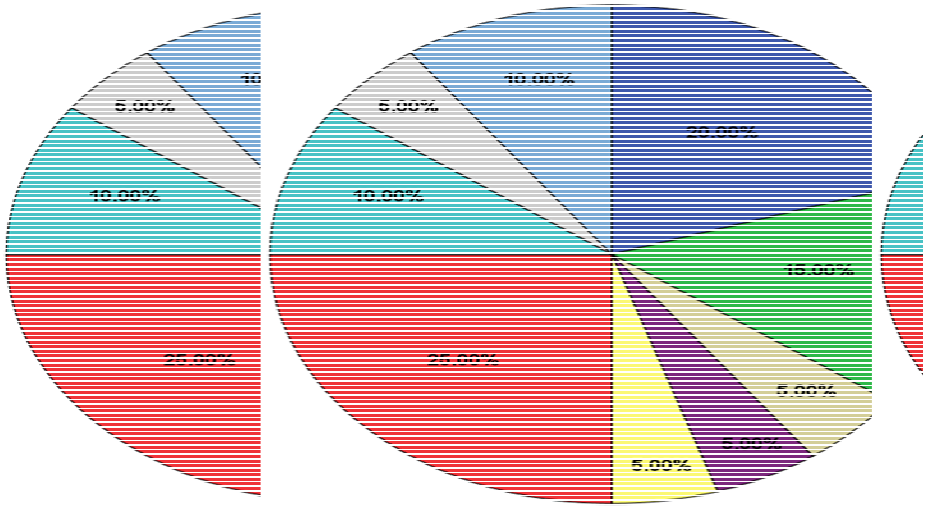


**Figure (2)** Frequency of bacterial species of USG sample

it is not, so contamination of this products perhaps came from environment and also from patient's skinn.

The results that attract the attention are thee identification of various bacterial types (Table - 2, Figure - 2) from USG samples that collected from hospitals and private clinics (Table - 3, Figure - 3, Table - 4 and Figure - 4). Both Gram positive and Gram negative bacteria werre isolated in different frequencies which comprise ***Staaphylococcus aureus, Staph. epidermides Pseudommonas spp., Burkholderia spp., Klebsiella, Enterobacte r spp.***…..etc.

These bacteria that recovereed in this study have an important role with many infectioons. Although ***Klebsiella*** is often found in the intestine and ***Pseudomonas aeruginosa*** is found in aqueouus environment, however, big problems could occur whe n such bacteria and also ***Staph. aureus*** be exposed to thee tissues [2].

Hutchinson *etal* 2004 [3] identified ***Enterobacter cloacae*** and ***Burkholderia cepacia*** and this results correspond to our result (Table- 4). Several researches [3, 4] mentioned ultrasound gel as a source for inffection.

**Table (3)** Frequency of bacterial species contaminated USG of private clinics

| Types of bacteriaa | NO. | % from + ve growth N=10 | % from total N=40 |
|---|---|---|---|
| **Gram + ve bacterria** | | | |
| *Staph. Aureus* | 2 | 20% | 5% |
| *Staph. epidermidiis* | 1 | 10% | 2.5% |
| *Micrococci* | 0 | 0% | 0 % |
| *Diphtheroids* | 1 | 10% | 2.5% |
| *Bacillus subtilus* | 0 | 0% | 0% |
| **Gram - ve bacter ia** | | | |
| *Pseudomonas sppp.* | 3 | 30% | 8.93%% |
| *Klebsiella spp.* | 2 | 20% | 5% |
| *Enterobacter* | 1 | 10% | 2.5% |
| *Burkholderia sppp.* | 0 | 0% | 0% |
| **Total** | 10 | 100% | |

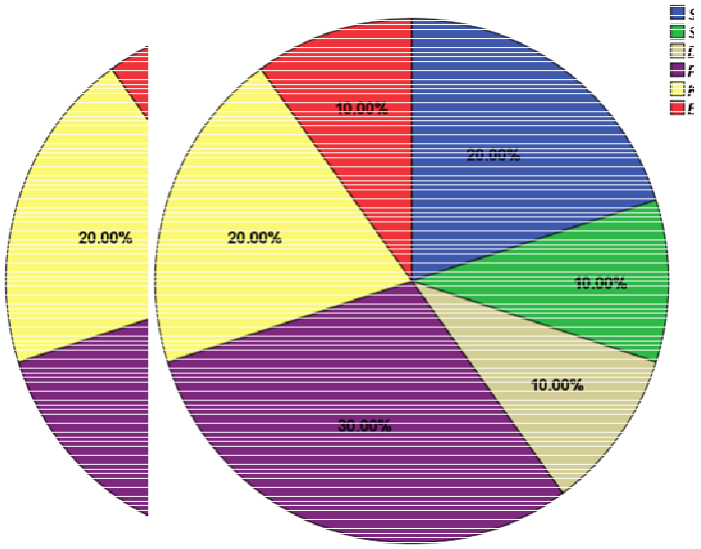


**Figure (3)** Frequency of bacterial species contaminated USG samples of private clinics

**Table (4)** Frequency of bacterial species contaminated USG of hospitals

| `Types of bacteria | NO. | %from +ve growth (N = 10) | %from total (N = 16) |
|---|---|---|---|
| **Gram +ve bacteria** | | | |
| *Staph. aureus* | 2 | 20% | 12.5% |
| *Staph. epidermidis* | 2 | 20% | 12.5% |
| *Micrococci* | 1 | 10% | 6.25 % |
| *Diphtheroids* | 0 | 0% | 0% |
| *Bacillus subtilus* | 1 | 10% | 6.25% |
| **Gram -ve bacteria** | | | |
| *Pseudomonas spp.* | 2 | 20% | 12.5% |
| *Klebsiella spp.* | 0 | 0% | 0% |
| *Enterobacter* | 0 | 0% | 0% |
| *Burkholderia spp.* | 2 | 20% | 12.5% |
| **Total** | 10 | 100% | |

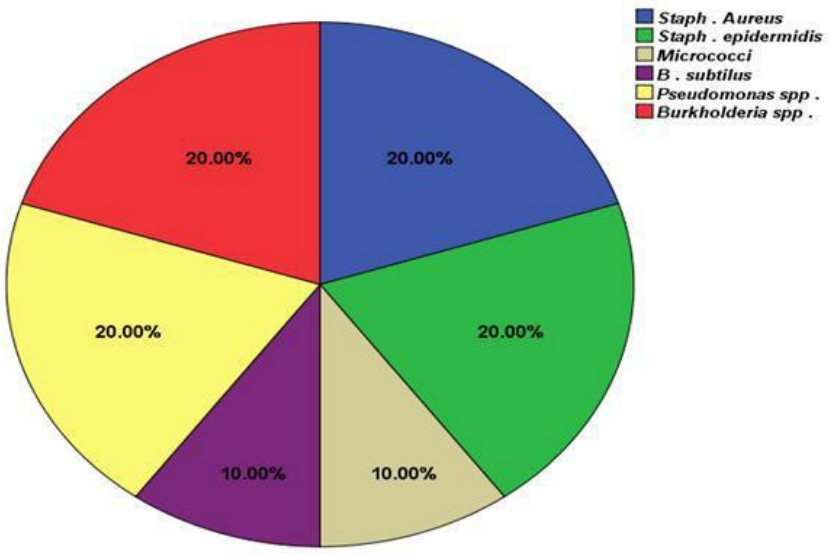


**Figure (4)** Frequency of bacterial species contaminated USG samples of hospitals

**Table 5:** Occurrence of bacterial growth in USG sample of opened & sealed containers

| Containers | Bacterial growth | | Total |
|---|---|---|---|
| | + ve | – ve | N (%) |
| Sealed | 3 | 15 | 18 (32.14 %) |
| Opened | 11 | 27 | 38 (67.86 %) |
| Total | 14 (25 %) | 42 (75 %) | 56 (100 %) |
| $\mathbf{X^2}$ = 0.982 **df** = 1 **P value** = 0.322 | | | |

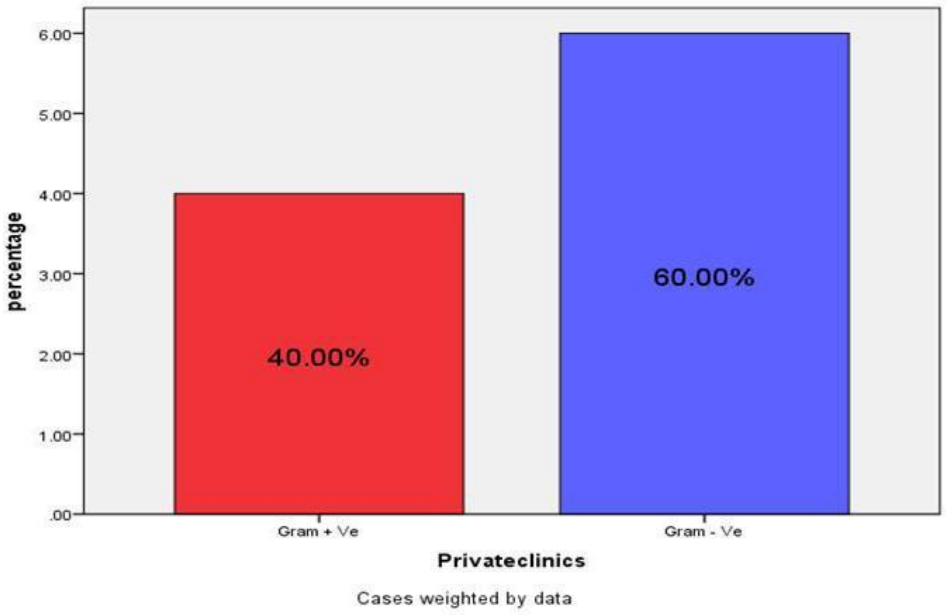


**Figure (5)** Frequency of bacterial species in private clinics in relation to Gram stain reaction

**Table 6:** Frequency of ba cterial species in sealed & opened gel containers

| Types of baccteria | Sealed N (%) | Opened N (%) |
|---|---|---|
| **Gram +ve baacteria** | | |
| *Staph. aureus* | 0 | 4 (20%) |
| *Staph. epiderrmidis* | 0 | 3 (15%) |
| *Micrococ ci* | 0 | 1 (5%) |
| *Diphtheroids* | 0 | 1 (5%) |
| *Bacillus subbtilus* | 1 (5%) | 0 (0%) |
| **Gram - ve baacteria** | | |
| *Pseudomonass spp.* | 0 | 5 (25%) |
| *Klebsiella spp.* | 0 | 2 (10%) |
| *Enterobacter* | 0 | 1 (5%) |
| *Burkholderiaa spp* | 2 (10%) | 0 (0%) |
| **Total** | 3 | 17 |

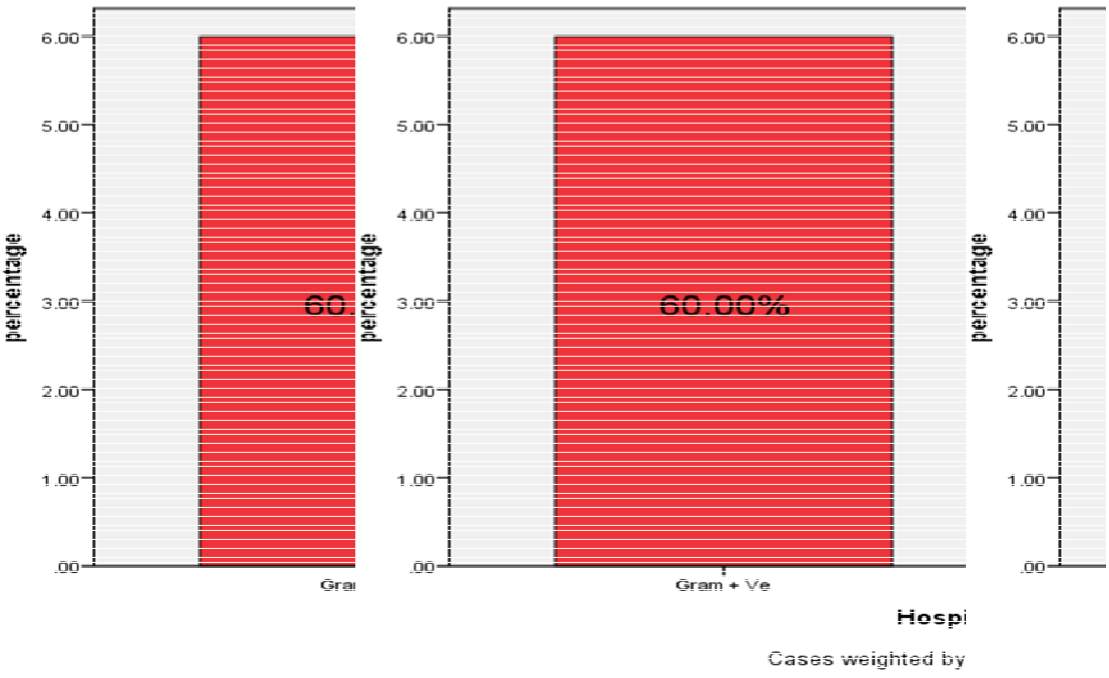


**Figure 6:** Frequency of bacterial species in hospitals in relation to Gram stain reaction

The environment in the USG was the suitable place which enhance the bacterial growth. [14] Some materials that used for stabilization of gel might be broken down by the activity of some bacteria during production and could be a source of contamination. Hutchinson *et al* 2004 [3] proved the ability of degrading parabens by Burkholderia and ***Enterobacter***. Outbreaks have been reported from gel with infection of ***Staph.aureus*** [4] ***Klebsiella*** and ***Burkholderia*** [15].

In this study ***Staph. aureus, Klebsiella***, ***Burkholderia*** and ***Enterobacter*** reported (28.57 %, 14.29,14.29 % and 7.14 %) respectively from positive cultures although some bacteria isolated just from hospital samples. This might be referred to prolong duration of usage of Ultrasound gels bottles in hospitals.

The other important results of this study showed that sealed and opened containers revealed bacterial growth although this growth present in opened containers high than that of sealed ones without any significant differences (table - 6). Contamination of USG samples occurs in opened bottles frequently as they become in contact with source of seeding bacteria in the USG that might come either from patient's skin or Ultrasounds probe specially if not cleaned carefully after examination. Also the majority of clinics and hospitals tend to refill small bottles from stock containers of gels and that play a role in increase contaminations.

In conclusion this result shows various bacterial species from USG samples that collected from hospitals and private clinics so the risk of getting infection in Ultrasound department adding another source for nosocomial infections. Besides that since not all bacteria that reported in this study could be a source of serious infection all the time, however, the risk still persists. Certainly all attempts should be made to decrease contamination. Strong recommendation

forward to minimize the health risks associated with Ultrasound gels by using sterile materials during manufacturing and production of gels. Besides that, sterile ultrasound gel should be used when caring critically ill patients and on intact skin or close to wounds. Also all containers of ultrasound gel should be changed each time after uses.

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