Comparison of DipNCount to Sterile Plastic Containers for Urine Transport

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Abstract

Objective:
The Dip N Count urine paddle (DNC, Starplex, Canada) is a urine collection device for semi-quantitative culture of urine consisting of a dip paddle housing cysteine lactose electrolyte deficient agar (CLED) and MacConkey agar (MAC) attached to a screw-top lid and suspended in a plastic vial. In comparison to a sterile plastic container (SPC), the DNC device has several theoretical advantages including decreased growth of contaminants and reduced turn-around time. We compare turn-around time and the contamination rate of urines submitted to our laboratory from two large community teaching hospitals, one using SPC and the other using DNC.

Method:
The results of all urines submitted for culture between January 2009 and July 2010 from either hospital were retrospectively reviewed. Urines received in SPC were inoculated to CLED and sheep blood agar plates. Urines were processed and results interpreted according to standard protocols. Briefly, isolates from urines collected by a non-invasive method were considered pathogens if the quantity was >=10^6 cfu/L and the total number of isolates on the plate was <=2 while >=3 pathogens were contaminated. Any isolate from urine collected by an invasive method was considered a pathogen. Pearson's chi-squared test was used to for statistical calculations.

Results:

Collection Device	No. Urines	No. Urines submitted/patient day	No. Urines with 'significant' growth (%)	No. Contaminated Urines (%)
DNC	19750	0.084	5297 (27)	69 (0.35)
SPC	25883	0.071	6856 (26.5)	228 (0.80)

E.coli, *Enterococcus spp.* and *Klebsiella spp.* were the most frequently isolated pathogens, accounting for 61% and 69% of specimens with significant growth collected using DNC and SPC respectively. Considering only these pathogens, 72% and 81% (*P<0.001*) were resulted within 48 hrs of receipt in the laboratory using DNC and SPC, respectively. The contamination rate was significantly lower (*P <0.001*) for the hospital using DNC compared to the hospital using SPC.

Conclusion:
In this study we compare urine culture results from two hospitals, each using a different device for transport of urine specimens to the microbiology laboratory. The hospital using DNC had significantly lower contamination rate. However, for at least the most common pathogens encountered, use of DNC lead to delayed results.

Introduction

Urinary tract infection (UTI) is one of the most commonly encountered infectious diseases and bacteriuria is considered by most clinicians as a definitive marker. In clinical microbiology laboratories, urine cultures generally represent a significant proportion of the workload. Diagnosis of UTI involves evaluation of both the quantity and pathogenic potential of the organism(s) present. Contamination of urine speicmens from perianal, vaginal, fecal or skin flora is a common finding when culturing urine, especially mid-stream urine specimens. Specimens should be processed as near to the time of collection as possible to minimize chances for increase in the actual colony count of any pathogens and contaminants present. However, this is not always feasible, especially when urine specimens are to be transported to off-site laboratories.

In this study, we retrospectively examine urine culture results collected at two large community – teaching hospitals, each using a different collection device. The aim of this study was to determine if use of a urine collection device such as the Starplex Dip N Count is superior to the standard sterile cup.

Figure 1. Collection and processing steps for urine collection using DipNCount and a sterile plastic container.

Urine collected in sterile plastic container
↓
Specimen held at 4°C (awaiting transit to lab)
↓
Specimen subcultured to CLED and BAP
↓
Incubated aerobically 35°C for 18-24 hrs
↓
Culture work-up according to standard procedures

Urine collected in sterile plastic container
↓
Dip N Count paddle immersed in urine
↓
Specimen held at 35°C (awaiting transit to lab)
↓
Incubated aerobically 35°C for 18-24 hrs
↓
Culture work-up according to standard procedures

Results

Table 1. Comparison of the submitting hospitals

	DNC	SPC
No. urines collected per patient day	0.084	0.071
Proportion of urines requiring workup collected by non-invasive procedure	98.6 %	97 %

•In this study we compare results from specimens submitted for urine culture from two distinct community, University-affiliated teaching hospitals in Toronto, Ontario.
•Each hospital used a different device for collection and transport of urine specimens to an off-site microbiology laboratory.
•Several factors were evaluated to establish comparability of the two hospitals as shown in Table. 1.

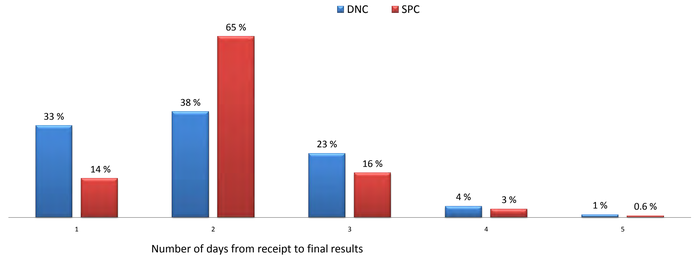
Table 2. Comparison of culture results from urine specimens collected using DipNCount (DNC) or a sterile-plastic cup (SPC).

	DNC	SPC
No. Urines Submitted	19,750	25,883
Positivity rate	27%	26.5%
Contamination rate	0.35% *P <0.001*	0.8%
Proportion of positive urines with "Other non-significant growth"	8.9%	15%

Method:
• Results of urine cultures submitted during an 18-month period from January 2009 to July 2010 were retrospectively reviewed.
•A urine specimen was considered positive if any amount of growth was present.
•Contamination rate was calculated as the number of urines with growth deemed "non-significant" according to standard urine evaluation protocols.
•Turn around time calculated as the time between receipt of the specimen in the laboratory to the availability of finalized results.
•Pearson's chi-squared test was used to for statistical calculations.

Results:
• The positivity rate using either collection device was similar
•The contamination rate was significantly lower (*P <0.001*) for the hospital using DNC compared to the hospital using SPC.
• Isolation of a urine pathogen along with other non-significant growth was noted for 15% of urines collected using SPC and 8.9% using DNC.

Figure 2. Comparison of turn around time.



Method:
• Time from receipt in the laboratory to final result was calculated for all positive specimens received during the 18-month study period.
•Specimens considered contaminated were excluded from analysis.
•Results are expressed as the proportion of total specimens resulted per day.

Results:
• For either collection method, 99% of specimens were resulted within 5 days of receipt in the laboratory.
• 71% of specimens collected using were resulted within 48 hrs, while 79% of those collected using a SPC were resulted in the same time frame.

Table 3. Comparison of turn around time for non-multi drug resistant *E.coli*, *K. pneumoniae* or *Enterococcus* spp.

	DNC	SPC
Proportion of urines with only non-MDR *E.coli*, *K. pneumoniae* or *Enterococcus* spp. isolated	61%	69%
Proportion of urines with only non-MDR *E.coli*, *K. pneumoniae* or *Enterococcus* spp. isolated and reported within 48 hrs of receipt in the laboratory	72% *P <0.001*	81%

Method:
• Results of urine cultures submitted during an 18-month period from January 2009 to July 2010 were retrospectively reviewed.
•Turn around time calculated as the time between receipt of the specimen in the laboratory to the availability of finalized results.
•Pearson's chi-squared test was used to for statistical calculations.

Results:
• Non-multi drug resistant *E. coli*, *K. pneumoniae* or *Enterococcus* spp. were the most commonly reported pathogens for urines collected using either device
•Considering only these pathogens, a 72% and 81% were resulted within 48 hrs of receipt in the laboratory for DNC and SPC respectively.

Results

Table 4. Categorization of delayed (>48 hrs) results.

Reason for delay in results	DNC	SPC
Mixed, subculture required for isolation	14	6
Subculture to re-evaluate (mixed or colony variation?)	5	15
Insufficient quantity – subculture required	2	6
Specimen improperly processed	2	0
Sensitivity results require further evaluation	5	4

Method:
• Workcards of 30 randomly chosen specimens were reviewed to determine the reason for delay in results.
•Specimens were limited to urines with either *E. coli*, *K. pneumoniae*, or *Enterococcus* spp. isolated and resulted after 72 hrs from receipt in the laboratory.

Results:
•Overall, assessing colony variation and subculture to isolate mixed cultures was the cause of the delay for the majority of the specimens reviewed for both collection methods.
•Improper specimen processing was noted for two DNC specimens. This included a specimen that was only partially "dipped". Another specimen was received on a DNC devise that had expired 9-months prior to receipt in the laboratory.
•A significant proportion of the DNC specimen evaluations were delayed due the culture being mixed, requiring subculture. For 2/14 specimens, the mixed culture was only noted on the Vitek purity plate. These specimens were delayed further to isolate the colony types and repeat testing.
•Specimens collected using a SPC were often delayed to differentiate mixed culture from colony variation. However, in most cases there was sufficient quantity of isolated colony to allow identification and susceptibility testing to be performed on the initial read.

Conclusion

Use of DNC device for urine collection has several theoretical advantages including decreased growth of contaminants and reduced turn-around time. In this study we sought to determine if these advantages were realized when used routinely by comparing urine culture results from a large community teaching-hospital using DNC for urine culture to a similar hospital using sterile plastic container for urine transport. Urine culture from both hospitals were submitted to the same off-site laboratory for processing and culture.

The positivity rate was similar for both hospitals. A significant decrease in the contamination rate was noted for the hospital using DNC (*P< 0.001*) . This result is most likely due to the fact that use of DNC allows for immediate inoculation of the urine specimen, preventing overgrowth of contaminants during transport.

The DNC did not however demonstrate a clear advantage over SPC for specimen turn around time. Indeed, a larger proportion of urines collected using DNC were able to be resulted within 24 hrs of receipt in the laboratory. However, the proportion of urines resulted within 48 hrs was similar for both devices (Figure 2). *E. coli*, *K. pneumoniae* and *Enterococcus* spp. represent a were the most common pathogens reported for either device. Identification and susceptibility testing of these organisms is expected to be completed within 48hrs. A comparison of the proportion of urines with *E. coli*, *K. pneumoniae* or *Enterococcus* spp. resulted within 48 hrs indicated that specimens collected in SPC were more likely to be available within this time frame (*P< 0.001*). The increased turn around time for DNC is most likely due to the small size of the paddle and the requirement for subculture to isolate colonies when two pathogens are present in high quantity. Interestingly, 2/30 DNC work card reviews revealed that delay in processing was due to improper inoculation of the device and receipt of an expired device. Ensuring that collection sites are educated on the proper use of the device and monitoring the expiration date is an important consideration when using the DNC.

Overall, utilization of the DNC device offers an advantage over SPC in the reduction of contaminated urines, however, this device does not reduce the turn around time for urine culture results.