

# Indwelling Catheter and Risk of Urinary Infection

## A Clinical Investigation with a New Closed-drainage System

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**Summary.** A new device for the drainage of an indwelling urethral catheter is described. The disposable one-piece-set includes the connector to the catheter, the tubing, and a cylinder to collect a urine aliquot up to 150 ml. Disconnection is impossible. The urine passes through a siphon which prevents air bubbles rising along the tubing. A urine sample for bacteriological culture can be withdrawn from the closed system by sterile puncture of this siphon. The calibration of the cylinder enables accurate measuring of urine flow rate even in oliguric patients. The apparatus was tested in 250 patients (1386 patient-days) by daily bacteriological cultures. Compared to the literature it is at the moment the most effective system preventing urinary infection during catheter drainage.

**Key words:** Urinary infection, Indwelling catheter, Urine drainage system, Siphon.

The management of a patient with an indwelling urethral catheter is a common problem. Even with full aseptic technique at the time of introduction of the catheter the risk of introducing infection into the urinary tract remains considerable. Once a catheter has been passed into the bladder without contamination there are still 4 possible routes of subsequent infection during the drainage period:

1. Entry of bacteria into the bladder alongside the catheter.
2. During disconnection of the drainage system.
3. Contact with stagnant urine in the drainage vessel which may become infected after a short time.
4. Transport of bacteria through the drainage tube by ascending air bubbles.

The first route seems to depend on anatomical factors. For this reason the incidence of infection is much higher in females. The other three routes of infection can be interrupted by the construction of the drainage system. Many special devices to avoid infection have been presented by the medico-technical industry and clinical investigators (4). We feel that apart from the practical advantages these systems

may offer, bacteriological investigation should prove the benefit to the patient.

The safest way to prevent air bubbles rising is a siphon. We have tested a system with such a device but one in which disconnection was still possible and which had to be opened for urine sampling for bacteriological analysis (2, 3). Encouraged by the good results obtained, the arrangement was improved and is now commercially available as a disposable one-piece-set. In this paper a clinical investigation on this new system is presented.

The siphon drainage system Diur-Asept<sup>1</sup> is a disposable sterile system with firm connections and a ribbed connector to the catheter. Therefore disconnections are impossible. Urine passes through a tube and enters the collecting cylinder via a siphon (Fig. 1). Air bubbles are prevented from ascending the tube to the bladder by this siphon. Urine drops from the siphon and is collected in the closed cylinder (Fig. 2). Urine flow rate can easily be determined by measuring the volume in the cylinder collected during a certain time. The first 12 ml are measured more precisely in a narrow

<sup>1</sup> Manufactured by: SSC, Steril Catgut Gesellschaft, CH-8212 Neuhausen/Switzerland

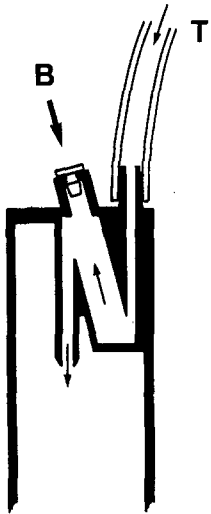


Fig. 1. The siphon built into the top of the urine drainage system "Diur-Asept" prevents air bubbles rising along the tubing (T) (see text). Having punctured the siphon by a sterile syringe through a rubber stopper (B) urine can be withdrawn for bacteriological culture

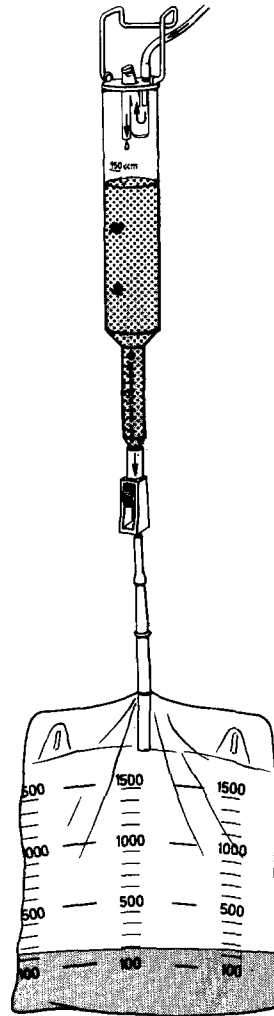


Fig. 2. The urine drainage system "Diur-Asept" is fixed on the bed and connected to a plastic bag. Urine dropping from the siphon is collected in the closed cylinder. After the volume has been measured the stopcock is opened and the urine runs into the plastic bag

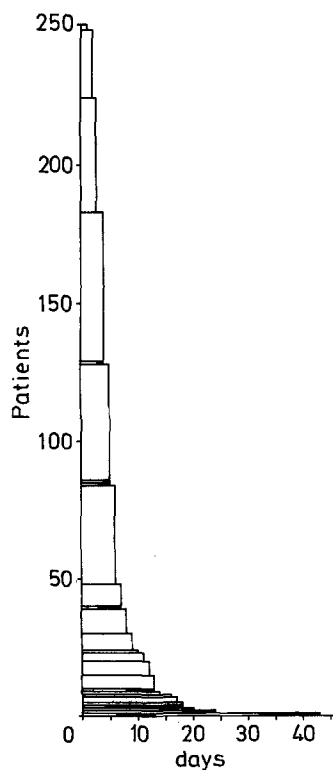


Fig. 3. Daily bacteriological cultures in 250 consecutive patients with an indwelling catheter drained by Diur-Asept. white = sterile urine black = positive cultures

Table 1. Incidence of urinary infection in patients with an indwelling catheter drained by different systems

Urine collecting system	patients with anuria included/excluded	patients				time of investigation		time of indwelling catheter		antibiotics
		total number	sex		patients with positive urine culture (%)	total number of days with urine culture	days with positiv culture (%)	mean value of all patients (days)	mean value of patients with positive culture (days)	
			male	female						
sterile closed plastic bag	excl.	10	10	-	60	86	48	8.6	1.3	
closed drainage with formaldehyde seal <sup>a</sup>	excl.	49	49	-	10.2	226	10	4.6	4.6	
siphon drainage with the possi- bility of disconnection <sup>b</sup>	incl.	100	43	57	10	571	10	5.7	12.2	methicillin + streptomycin <sup>c</sup>
	excl.	94	39	55	4.2	427	1.8	4.54	3.3	
closed siphon drainage with- out discon- nection (Diur-Asept)	incl.	250	136	114	3.6	1386	3.5	5.6	15.4	methicillin + streptomycin <sup>c</sup>
	excl.	247	136	111	2.4	1299	1.2	5.3	8.7	

<sup>a</sup> Roberts, J. B. M. et al., 1965

<sup>b</sup> Wolff, G. et al., 1970 (2)

<sup>c</sup> First 3 days after open-heart surgery

lower portion of the cylinder. This enables the system to be used in oliguric patients and young children. On opening the stopcock the urine passes into a disposable plastic bag. The siphon can be punctured by a sterile needle and a urine sample withdrawn with a sterile syringe for bacteriological culture.

## PATIENTS AND METHODS

This closed siphon drainage system was tested in a consecutive series of 250 patients after open-heart surgery needing an indwelling catheter for circulatory monitoring. 136 were males, 114 females.

The urethra was never disinfected before catheterisation. The bladder was never irrigated nor the catheter changed. Once a day a sample of urine was withdrawn for bacteriological culture. A bacterial count of 100,000 organisms per millilitre was regarded as a positive culture.

## RESULTS

In Table 1 our results are compared to others from the literature. Fig. 3 shows the detailed analysis. The urine was cultured on 1386 patient-days. 48 (3.5%) of the cultures were positive. Of the 250 patients 9 (3.6%) had a positive

culture on at least one day. The mean duration of the indwelling catheter was 5.6 days in all patients and 15.4 days in the patients with a positive culture. 3 patients were oliguric and had periods of anuria; of the other 247 patients 6 (2.4%) had a positive culture on at least one day. On 1299 patient-days their urine was cultured and on 16 days (1.3%) the culture was positive.

## DISCUSSION

In a consecutive series of 250 patients with an indwelling urethral catheter connected to a closed siphon drainage system (Diur-Asept) the incidence of urine infection was markedly lower compared with the best results in the literature (1).

Diur-Asept is a disposable set which makes the care of an indwelling catheter time-saving, clean and easy. The siphon prevents air bubbles rising in the tubing and averts this important vector in infection.

Additionally, ascending air bubbles would displace urine from the tubing which could - in an oliguric patient - give rise to the false impression that urine flow had increased. Therefore the closed siphon drainage is not only a safe method preventing urinary infection but also an accurate one to monitor the urine flow rate in oliguric patients.

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