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► **To cite this version:**

E Cousin, A Ryckewaert, C de Jorna Lecouvey, a P Arnaud. Urine collection methods used for non-toilet-trained children in pediatric emergency departments in France A medical practice analysis. Archives de Pédiatrie, Elsevier, 2019, 26 (1), pp.16-20. 10.1016/j.arcped.2018.11.005 . hal-01976756

**HAL Id: hal-01976756**

**<https://hal-univ-rennes1.archives-ouvertes.fr/hal-01976756>**

Submitted on 21 Oct 2021

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**Urine collection methods used for non-toilet-trained children in pediatric emergency departments in France: a medical practice analysis**

Short title: Urine collection methods used for non-toilet-trained children in pediatric emergency

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**Funding :** No funding was secured for this study.

## **Abstract**

### **Introduction :**

Since April 2015, the French Society of Pediatrics has encouraged suprapubic aspiration (SA) and urethral catheterization (UC) for urine collection in non-toilet-trained children suspected of having urinary tract infections (UTIs) and has tried to reduce the use of urine bag (UB).

### **Objective :**

To analyze the medical practices concerning urine collection methods used for non-toilet-trained children in pediatric emergency departments in France.

### **Methods :**

We conducted a descriptive medical practice study in October 2017. All members of the French Society of Pediatric Nephrology received two questionnaires about urine collection methods used for non-toilet-trained children, distinguishing between male and female patients, and about the corresponding analgesic protocols used in their pediatric emergency departments.

### **Results :**

In total, 26 centers completed questionnaires concerning female patients. UC was performed in cases of fever associated with urinary tract malformations in 14 of 26 centers (54%). UB was used in cases of fever of unknown origin lasting for more than 48 h in 17 of 26 centers (65%), in cases of fever associated with UTI symptoms in 14 of 26 centers (54%), and in cases of fever in infants under 3 months of age in 16 of 26 centers (61%). The questionnaires concerning male patients were completed by 30 centers. UB was the initially used urine collection method in all situations with, respectively, 22 of 30 (73%), 27 of 30 (90%), 23 of 30 (77%), and 22 of 30 (73%) centers. The analgesic protocol for urine collection is not well-established in France.

### **Conclusion :**

UC for urine collection in pediatric emergency departments in France is underused despite the national recommendations and the greater diagnostic power of this method compared with UB.

**Keywords :** Urinary tract infection, urine collection methods, non-toilet-trained children

**Conflicts of interest :** none.

## 1. **Introduction**

Urinary tract infections (UTIs) are a frequently suspected cause of fever in non-toilet-trained children in pediatric emergency departments [1,2]. The choice of the urine collection method used is decisive for the reliability of the diagnosis of UTI in this population. Three methods are usually used in emergency departments. First, suprapubic aspiration (SA) is frequently recommended as a gold standard in official guidelines [3] but its use remains rare in Europe [4,5] because of its limited success rate (25%–60%) [6], especially when used without ultrasound imaging guidance [7]. Another limitation is the associated pain that has been reported to be greater than for urethral catheterization [8]. The second method based on urine bag (UB) collection remains widely used because of its practical aspects despite its well-known limitations, including a high contamination rate (30%–70% risk of obtaining a contaminated result on urine culture) [9-12]. Last, urethral catheterization (UC) appears to be the best option to limit the bacterial contamination rate of urine collection and the associated pain [10,11].

Since April 2015, the Pediatric Infectious Diseases Group of the French Pediatric Society has encouraged suprapubic aspiration and UC for urine collection considering their greater diagnostic power in non-toilet-trained children suspected of having UTIs. At the same time, these recommendations encourage professionals to reduce the use of UB in France because of its poor specificity. The Pediatric Infectious Diseases Group of the French Pediatric Society has reminded that: "The confirmation of the UTI by urine culture should prefer other methods of sampling than

the urine bag : sampling jet, urethral catheterization, or pubic puncture" [13].

The aim of this study was to describe the medical practices concerning urine collection methods for non-toilet-trained children and the analgesic protocols used in pediatric emergency departments in France, 2 years after the publication of the new national recommendations.

## 2. **Methods**

We conducted a descriptive medical practice study. In October 2017, we sent two questionnaires by e-mail to the members of the French Society of Pediatric Nephrology (SNP) in academic or general hospitals : one questionnaire concerning female and one concerning male patients. We imposed that only one practitioner per center complete the questionnaires in collaboration with the pediatrics emergency physicians and one answer per center was requested. Each questionnaire contained 10 questions (single or multiple choices) (Appendix 1) focusing on urine collection methods used for non-toilet-trained children in the pediatric emergency departments and the analgesic protocols. The results were collected and analyzed via SurveyMonkey®.

## 3. **Results**

### **3.1. Indications for the urine collection method**

All the results are presented in Table 1. Questionnaires were sent by e-mail via the mailing list of the SNP (29 academic hospitals and 20 general hospitals) in France. Briefly, 26 questionnaires concerning female patients were completed (academic hospitals : 20/26, general hospitals : 6/26). UC was performed as the first urine collection method in cases of fever associated with urinary tract malformations in 14 of 26 centers (54%) versus 12 of 26 (47%) for UB. UB was the initial used method in the three others situations (Table 1 A). In total, 30 centers completed the questionnaire concerning males (academic hospitals : 22/30, general hospitals : 8/30). UB was the initial urine collection method in all situations (Table 1 B). Only one centers performed SA for

urine collection in cases of fever in male and female infants under 3 months of age.

### 3.2. Medical practices depending on the urine strip test

All the results for this section are presented in Table 2. When the urine test strip revealed a low pretest probability of UTIs (negative for nitrites and positive for leukocytes), 9 of 26 (36%) centers interviewed still performed bacteriological analyses of the urine sample from the urine bag to confirm the diagnosis of UTIs in female and 21 of 30 centers (70%) in male patients (Table 2).

When the urine test strip revealed a high pretest probability of UTIs (positive for nitrites and positives for leukocytes), 11 of the 23 (44%) centers interviewed still performed bacteriological analyses of the urine sample from the urine bag to confirm the diagnosis of UTI in female and 21 of 30 centers (70%) in male patients (Table 2).

### 3.3. Results of pain evaluation

Of the 26 centers interviewed, 20 (76%) considered that UC was less painful than or as painful as the withdrawal of UB in female patients versus 20 of 30 (67%) stating this for male patients. Six of the 26 centers (24%) considered that UC was more painful than the withdrawal of UB in female patients versus 10 of 30 (33%) stating this for male patients. (Figure 1)

Regarding the withdrawal of UB, 19 of the 30 (63%) centers interviewed did not prescribe analgesics for male patients and 12 of 26 centers (48%) did not prescribe analgesics for female patients.

With respect to the UC procedure, concerning females and males, only one center did not prescribe analgesics whereas a majority used distraction, PO glucose solution, nitrous oxide, PO paracetamol, and lidocaine gel (Figure 2).

## 4. Discussion

Despite numerous well-established recommendations [5,13-15], this study confirms that UC is underused in pediatric emergency departments. UB remains widely used as the initial urine collection method regardless of the patient's gender, except in cases of fever associated with urinary

tract malformations in girls. These practices increase false-positive findings and lead to a high level of misdiagnosis of UTIs, unjustified biological analyses, excessive medical imaging, and prolonged hospitalization [2,5,9-13]. For Al Orfi et al. [9], the use of UB compared with UC is significantly associated with an increase of unnecessary recall (OR : 4.9, 95% CI [2.3–10.5]), unnecessary treatment (antibiotics) (OR : 4.8, 95% CI [1.8–12.4]), prolonged treatment (OR : 15.6, 95% CI: [2.1–116.8]), unnecessary radiologic investigations (OR : 4.1, 95% CI [1.4–12.1]), and unnecessary admission (OR : 12.4, 95% CI [1.6–95.5]).

We show that a large proportion of the interviewed centers performed urine culture on samples from UB. The Pediatric Infectious Diseases Group of the French Pediatric Society has reminded that bagged urine samples may be used for urinalysis (urine strips) but should not be used for urine culture and encourages the use of the other urine collection methods [13]. However, we note that the majority of interviewed centers used UC to confirm UTI in cases of positive or questionable urine test strip results in girls.

In this study, we sent questionnaires to the members of the French Society of Nephrology, and emergency pediatricians were requested in collaboration to complete them in each center. Thus, only a small percentage of the 267 French pediatric emergency departments were contacted since we did not involve the French Society of Pediatric Emergency, which limits the external validity of our study.

To describe the current practice among European pediatricians regarding the diagnosis and management of UTIs in children aged 1–36 months and to compare these practices with recently published guidelines, Hadjipanayis et al. led a large-scale survey among 1,129 pediatricians [16]. They showed that the preferred method of urine collection is the use of a bag (53% for infants <3 months and 59% for children 4–36 months of age). The authors concluded that the three most recent UTI guidelines (the National Institute for Health and Care Excellence (NICE) [14], the American Academy of Pediatrics [2], and the Italian Society of Paediatric Nephrology) were not

followed properly.

On the one hand, the results of this study emphasize the fact that pain caused by the withdrawal of UB is underestimated, as described by Lamy et al. [17]. More than half of the interviewed centers did not prescribe analgesics in this situation whatever the gender of the patient. Nevertheless, UB was considered more painful than UC in girls by 10 of the 26 centers (38%), and by 8 of the 30 centers (26%) in boys. On the other hand, this study highlights the fact that the pain caused by UC is not underestimated by the physician because only one center did not prescribe analgesics for this procedure. Currently, the French association of pediatric pain *Pediadol* ([www.pediadol.org](http://www.pediadol.org)) and the "*centre national de lutte contre la douleur*" (CNRD) strongly encourage the use of nitrous oxide and oxygen gas mixture for UC [18,19]. In addition, they consider that lubrication of the sterile probe with sterile Vaseline facilitates the introduction and decreases pain. Nonetheless, the use of 1% gel as local analgesia (3 mL/10 kg) for UC in boys is controversial and studies have not definitively proven the effectiveness of this procedure [20]. According to Lamy et al. [17], it is necessary to evaluate more precisely these analgesic procedures and also the administration of oral glucose solution in association for UC.

In our survey, no question focused on the cutaneous stimulation technique for inducing on-demand urination. Suprapubic stimulation in infants can facilitate collection of a clean catch urine specimen [21,22]. Herreros Fernandez et al. [23] reported a success rate of 86.3% for a cutaneous stimulation technique to induce urination in newborns for the purpose of collecting urine samples within the first 5 min of the procedure. However, a more recent study revealed less encouraging results, with a success rate of only 27% in non-toilet-trained children [24]. For the authors, these global mixed results suggest the importance of training of the person performing the technique. In addition, M. Valleix-Leclerc et al. [24] found that the main limitation of the procedure was weight, which caused obvious difficulties in keeping the child in a good position. The authors concluded that cutaneous stimulation to provoke micturition for sample collection is less effective in non-



toilet-trained children than in newborns. It nonetheless remains an advantageous option in infants less than 3 months old. In this study, we found that the clean catch method is not yet routinely used in the majority of pediatric emergency departments. More studies are needed to determine the role of this method in the management of infants suspected of having UTI in pediatric emergency departments.

In this study, we did not consider the management of UTIs before admission to the hospital. However, in order to improve UTI management and mostly the diagnostic approach, we think the general practitioners have to be informed of the national recommendations. In order to reduce misdiagnosis of UTIs, unjustified biological analyses, excessive medical imaging, and prolonged hospitalization, UC could be performed in private laboratories or by domiciliary nurses. More studies are needed to evaluate the feasibility of this procedure. We hope that studies like this one will improve the visibility of the French recommendations concerning urine collection methods in children and will encourage the use of urethral catheterization as recommended.

## 5. **Conclusion**

UC is underused in pediatric emergency departments despite well-established recommendations. UB remains widely used as the initial urine collection method regardless of the patient's gender and this practice leads to a large proportion of misdiagnoses of UTIs. There is no well-established protocol for the management of pain associated with the withdrawal of UB and UC in France. It may be necessary to evaluate in more detail the analgesic procedures by conducting comparative prospective studies.

**Conflicts of interest** : None

## **Acknowledgments**

We acknowledge the support and participation of all the members of the French Society of

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### **Figure legends and tables :**

**Figure 1** : Physicians' evaluation of the pain caused by different urine collection methods **A** :

Males, **B** : Females

UC: urethral catheterization ; UB: urine bag

**Figure 2** : Analgesic protocols used **A** : in cases of withdrawals of UB (females and males) and **B** :

in cases of UC (females and males)

UC: urethral catheterization ; UB: urine bag

**Table 1** : Urine collection methods used for non-toilet-trained children in pediatric emergency departments in France for female A) and male B) patients.

UC: urethral catheterization ; UB: urine bag; SA: suprapubic aspiration; UTI: urinary tract infection

**Table 2** : Medical practices regarding the urine test strip for females and males.

### **Complementary material**

Appendix 1

<http://www.sciencedirect.com,doi...>

UC : urethral catheterization, UB : urine bag

Figure 1

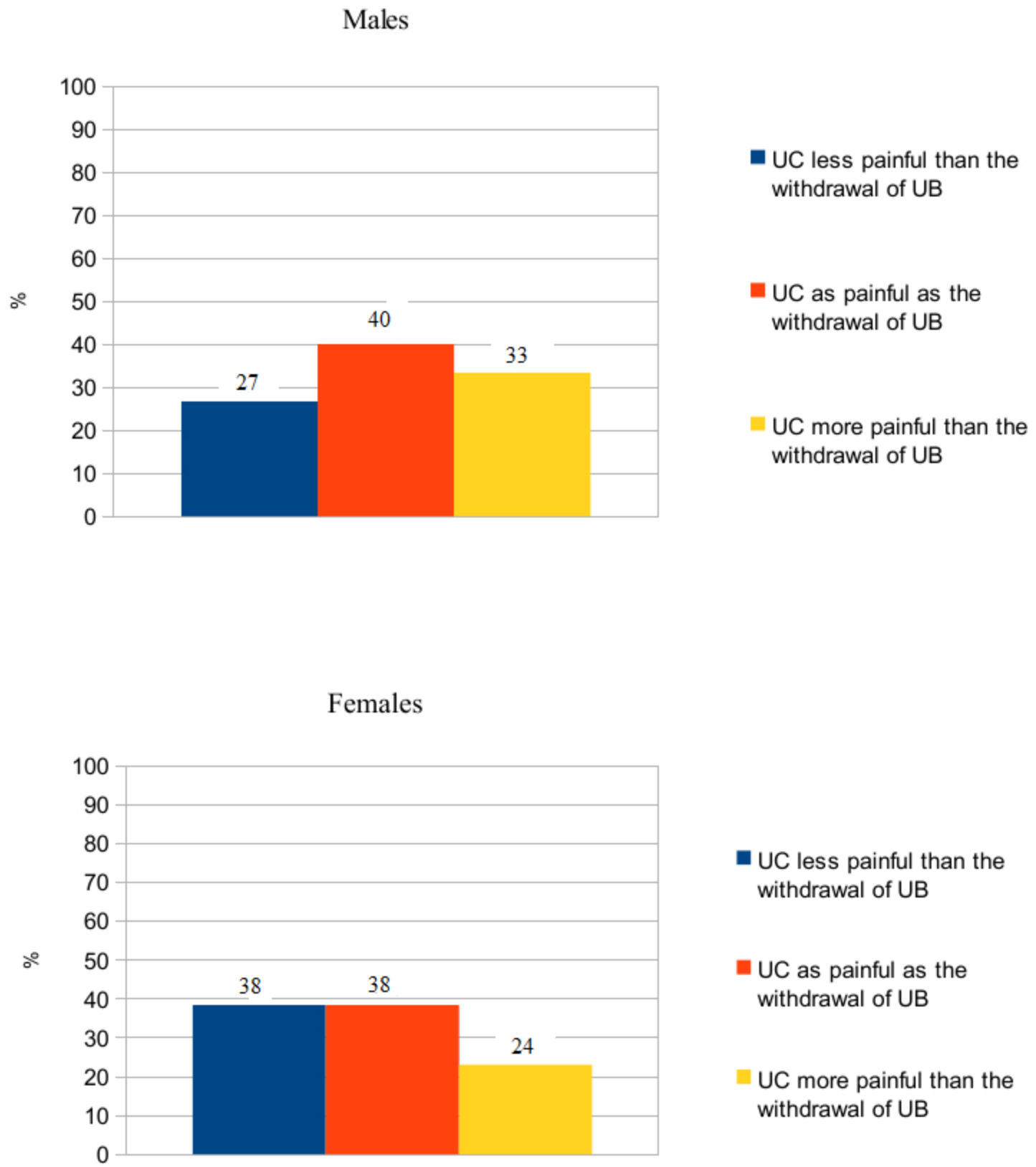


Figure 2

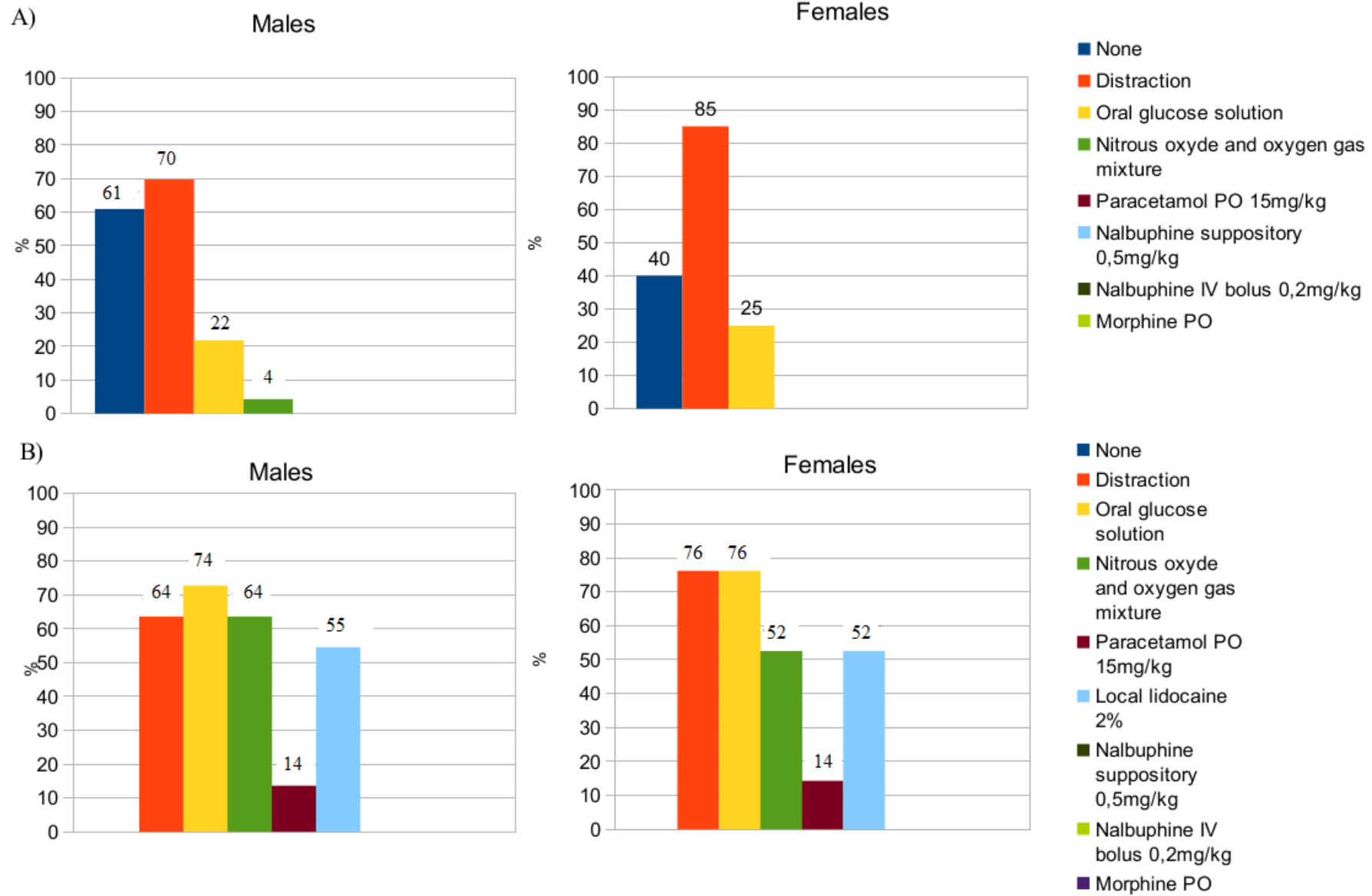




Table 1 : : Urine collection methods used for non-toilet-trained children in pediatric emergency departments in France for female A) and male B) patients

	Females					
	UB		UC		SA	
<i>n</i> = 26	number of centers	%	number of centers	%	number of centers	%
Fever associated with urinary tract malformations	12	47	14	54	0	0
Fever of unknown origin lasting for more than 48h	17	65	9	35	0	0
Fever associated with UTI symptoms	14	54	12	46	0	0
Fever in infants under 3 months of age	16	61	9	35	1	4

**B)**

	Males					
	UB		UC		SA	
<i>n</i> = 30	number of centers	%	number of centers	%	number of centers	%
Fever associated with urinary tract malformations	22	73	8	27	0	0
Fever of unknown origin lasting for more than 48h	27	90	3	10	0	0
Fever associated with UTI symptoms	23	77	7	23	0	0
Fever in infants under 3 months of age	22	73	7	23	1	4

Table 2 : Medical practices regarding the urine test strip for females and males.

**A)**

	Females			
	Urine test strip nitrites and leukocytes positive		Urine test strip nitrite negative and leukocytes positive	
<i>n</i> = 26	number of centers	%	number of centers	%
Bacteriological analyses of the urine sample from the urine bag	11	44	9	36
New urine collection by urethral catheterization	15	56	17	64

**B)**

	Males			
	Urine test strip nitrites and leukocytes positive		Urine test strip nitrite negative and leukocytes positive	
<i>n</i> = 30	number of centers	%	number of centers	%
Bacteriological analyses of the urine sample from the urine bag	21	70	21	70
New urine collection by urethral catheterization	9	30	9	30