

On the Pathogenesis of Simple Renal Cysts in the Adult

A Microdissection Study

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Received: July 30, 1976

Summary. The simple cyst in the adult seems to be mainly an acquired disorder. Microdissection of the nephron in the adult kidney points to the presence of diverticula on the distal tubule as the starting point of the affection. A degree of obstruction in the urinary tract together with normal involutional phenomena of the basal membrane, both typical of the aging process, are believed to be precipitating factors.

Key words: Microdissection - Renal cyst.

An asymptomatic space occupying lesion in the kidney appears to be a frequent finding, especially in the elderly. A wide range of diagnostic techniques have been developed to distinguish simple cysts from renal tumours. In recent classifications, these simple cysts have been grouped among the acquired cystic affections, and clearly differentiated from the hereditary polycystic diseases and dysplasias (1, 2). Microdissection provides a method of obtaining more information concerning the origin of cysts and their location on the nephron and collecting system.

The aim of the present study was to obtain more information concerning the pathogenesis of the simple cysts by tracing morphological anomalies which might be the origin of cystic pathology in the nephron and collecting tubules.

Normal and cystic kidneys of adult and elderly patients were examined by microdissection. The investigation was completed with a study of the incidence of simple cysts.

MATERIAL AND METHODS

The sample was divided into two groups:

Group 1. Normal adult kidneys. There were 24 biopsies, 16 of them from the patients over 60 years of age.

Group 2. Kidneys with simple cysts. 8 biopsies.

Renal tissue was obtained by nephrectomy, partial nephrectomy or at autopsy. Wedge-shaped pieces of tissue not more than 2 mm in thickness were cut from the coronally bisected kidney to include the cortex and medulla in continuity from the capsule to the tip of pyramid and a number of representative samples from various areas of the kidney were examined. Care was taken to select only those cases that showed no evidence of hypertension or renal disease during life and those kidneys that on a macroscopic examination showed no evidence of scarring or "pyelonephritis".

The representative fragments were macerated in concentrated hydrochloric acid for between 40 and 48 hours (3). The fragments were then bathed in distilled water and the dissection performed between 24 and 36 hours after maceration.

Twenty nephrons and 10 collecting tubules were dissected from each kidney and examined morphologically. Appropriate mosaic photomicrographs were made of isolated nephrons and collecting ducts.

A complementary clinical study was conducted in patients with cystic pathology.

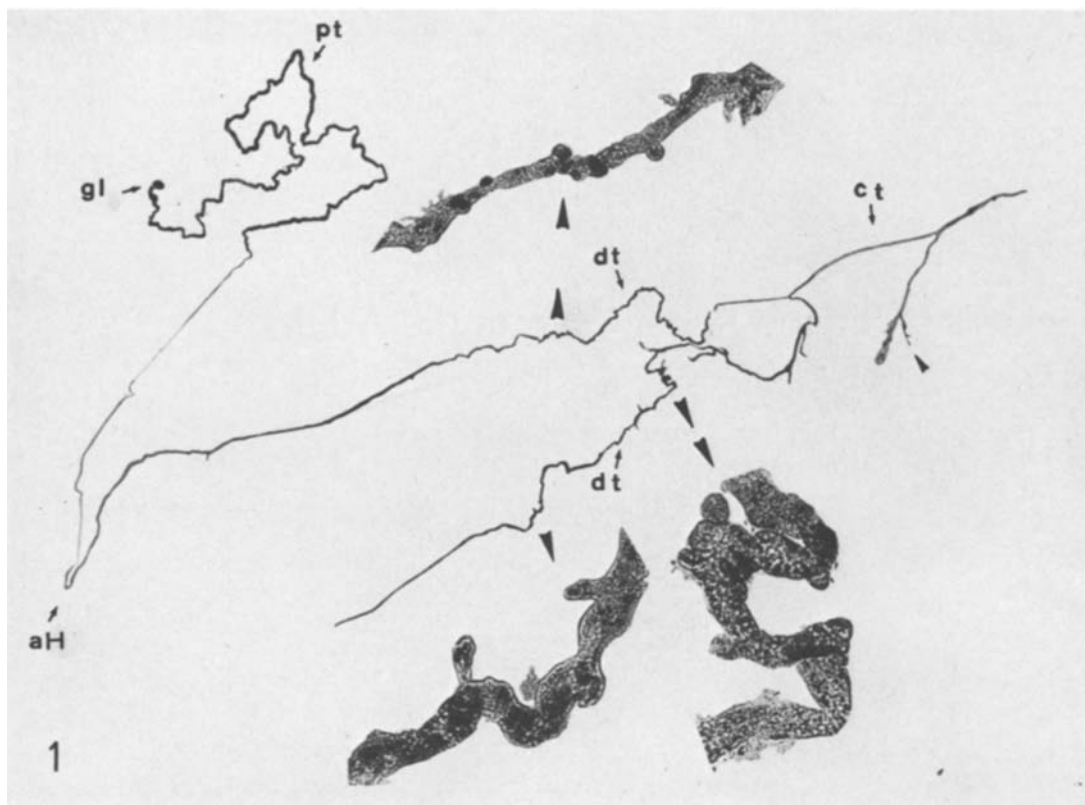


Fig. 1. Mosaic photomicrograph of complete nephron from normal kidney of 68-year-old man showing diverticula on distal convoluted tubule. (x 9,4; details x 150) gl: glomerulus, Pt: proximal convoluted tubule, aH: Henle's loop, dt: distal convoluted tubule, ct: collecting tubules

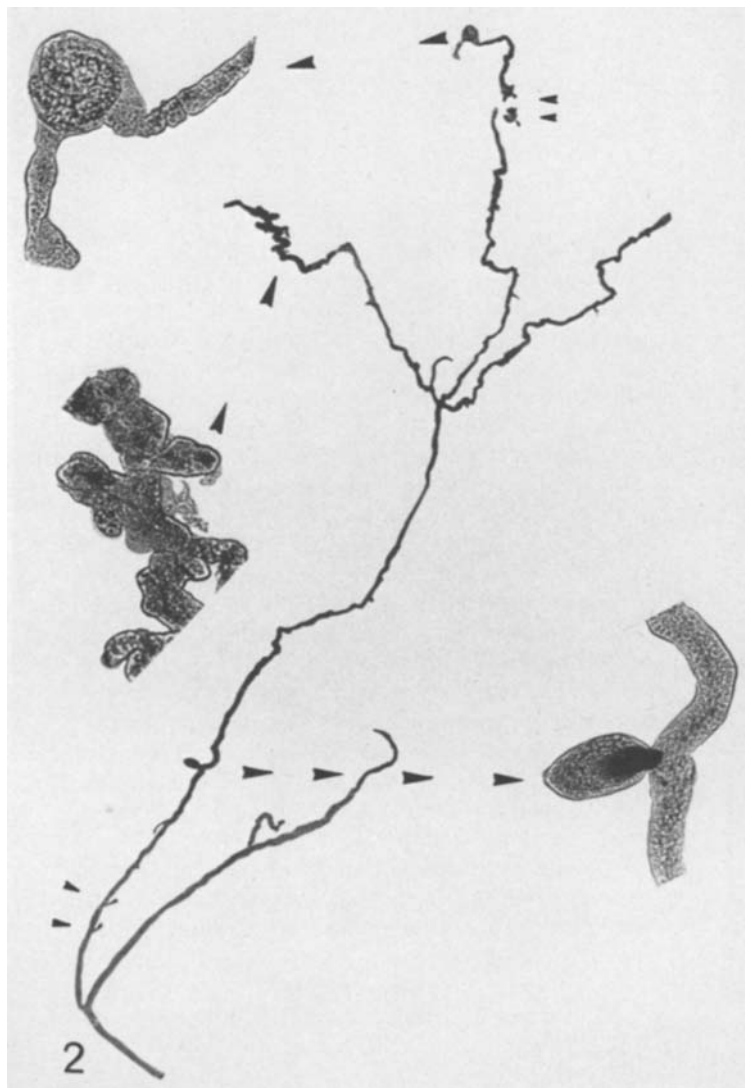


Fig. 2. Mosaic photomicrograph of portions of distal tubules from a kidney with a simple cyst in a 70-year-old man. Pedunculated diverticula (arrows) on collecting tubule and on distal convoluted tubules (x 23,45 details x 150)

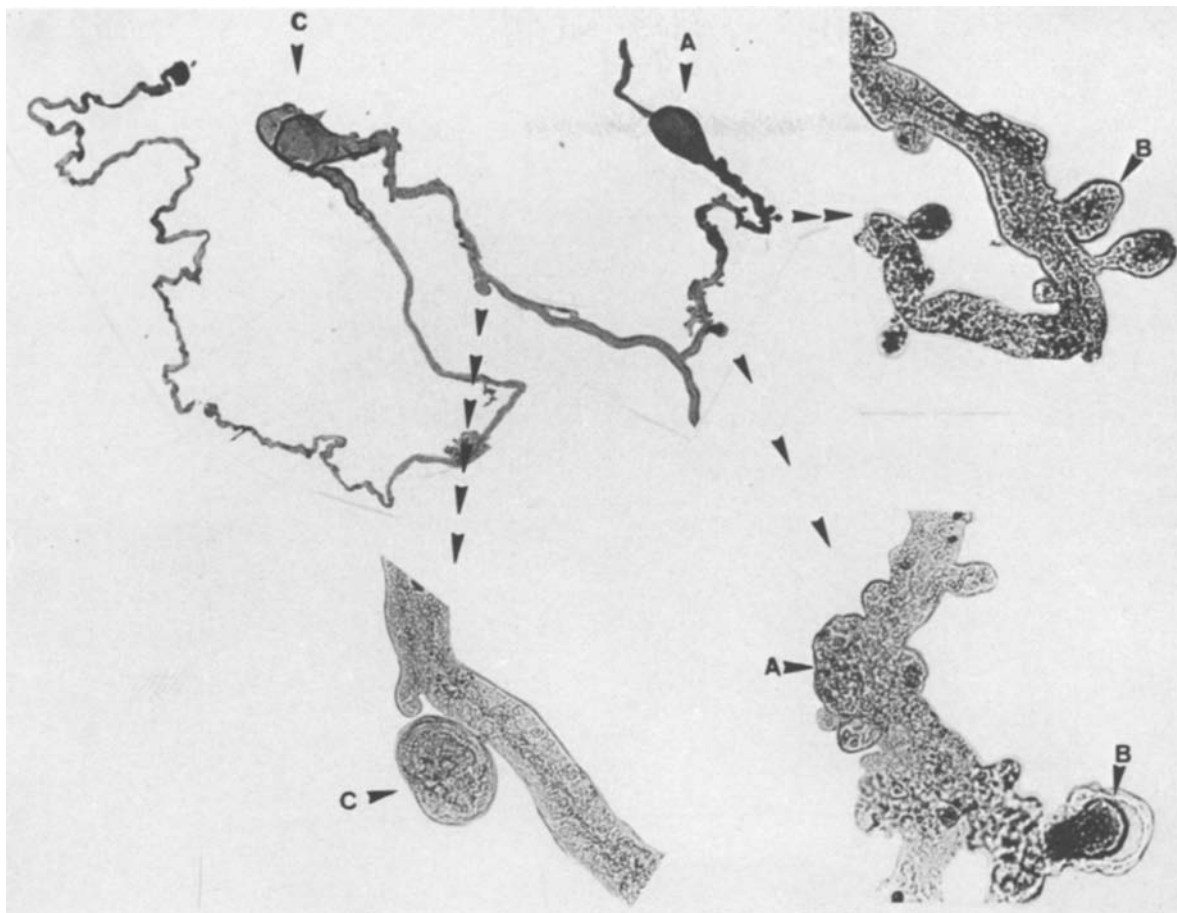


Fig. 3. Mosaic photomicrograph of portions of nephron from a 65-year-old man presenting with a simple cyst. Transition from ectasia (A), diverticulum (B) to cysts (C) are observed on the distal tubule (x 23,45; details x 150)

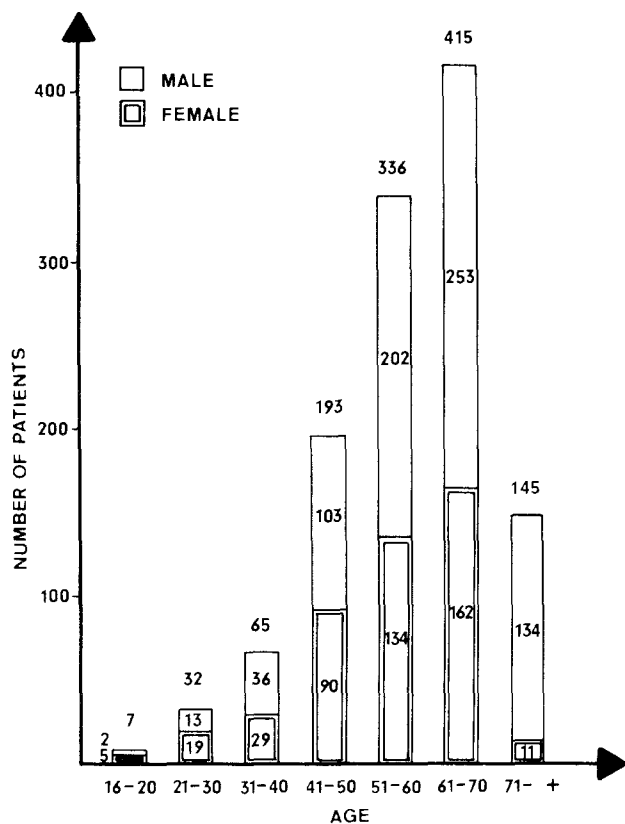


Fig. 4. Incidence of simple renal cysts with age

RESULTS

The microdissection study of adult kidneys and those from elderly patients always revealed diverticula on the distal tubules (Fig. 1). They were particularly numerous in the elderly. A minimum of 3 and a maximum of 20 diverticula were counted on each distal convoluted tubule. This is in agreement with the observations reported by Darmady et al. (4) who, in addition, noted a linear increase in incidence with age (Fig. 5).

The microdissection study of kidneys with simple cysts showed a similar picture with a high incidence of diverticula on the distal convoluted tubules as well as on the collecting tubules (Fig. 2). Besides these diverticula, cystic ectasia, especially of the distal tubule was noted. Ectasia affecting the loop of Henle occurred less frequently. Transition between diverticula, ectasia and cysts were observed in the distal tubule of the same kidney (Fig. 3).

In a clinical study of two series of patients with simple cysts (1342 case records and 301 cases) it appeared that the simple cystic pathology is found mainly in male patients. Cysts were detected radiologically and diagnosis was confirmed by percutaneous puncture and opacification or exceptionally by operation. Of the 1342

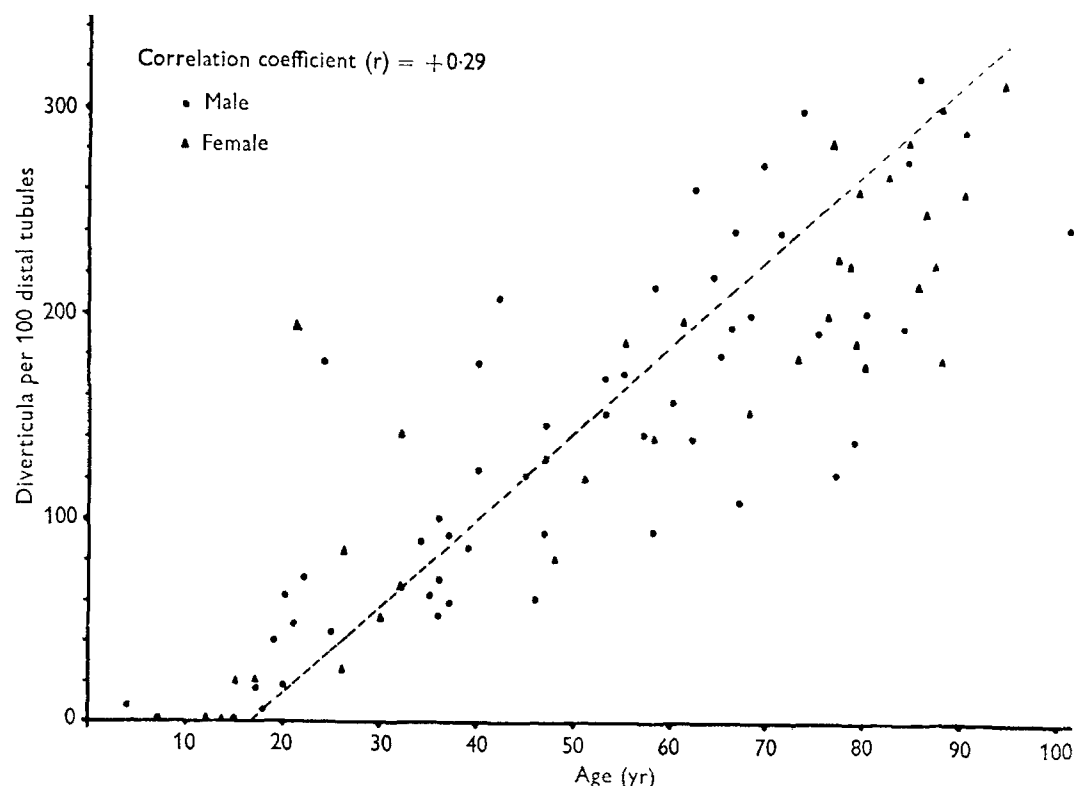


Fig. 5. Number of renal tubular diverticula related to age (from (4) with permission)

patients of the first series 60% were men and 71% of the 301 observations of the second group were in male patients. There is a striking increasing incidence of the simple cysts with age, reaching a maximum around the 7th decade (Fig. 4). Four out of every 5 men who developed cysts were more than 50 years of age.

There was a remarkable incidence of simple cysts among patients suffering from prostatism. Of 689 patients in whom the cysts were said to be asymptomatic, 284 (31%) had presented with prostatism.

DISCUSSION

The normal nephron has regular outlines without protrusions. However, diverticula are relatively frequent on the distal convoluted tubules in kidneys that show no other anomalies, yet they are uncommon under the age of 4 (5).

That the number of diverticula increases with age has long been demonstrated (6, 7). A study of the aging kidney has shown a linear increase in the number of diverticula on the convoluted tubule (4). Kidneys with simple cysts were excluded from this series (Fig. 5).

These findings were confirmed by our study. A large number of diverticula (between 13 and 20) were always found on each distal tubule in the patient group over 60 years of age. Kidneys with simple cysts also show diverticula

on the distal convoluted tubule. The diverticula occur with similar frequency in kidneys without cysts, but besides diverticula, ectasia and cystic dilatation were frequently observed, especially on the distal tubule in kidneys with simple cysts. Other sites, such as Henle's loop and the collecting tubules were rarely affected. Progressive transitional forms between a diverticulum on the distal tubule and the microscopic cyst were found on the same part of the nephron or on other nephrons in the same kidney.

A previous microdissection study of obstructed kidneys (8) showed the same pattern of diverticula on the distal convoluted tubule, Henle's loop and the collecting tubules (Fig. 6). Macroscopic cysts were also observed.

In other kinds of cystic affections of the kidney, diverticula, ectasia and cysts on one or other part of the nephron are believed to represent the early stages of macroscopic cysts. We therefore believe that the diverticula and ectasia, which are located on the distal tubule are the precursors of some simple cysts.

The linear increase in the frequency of these diverticula with age (Fig. 5) correlates well with the increasing incidence of simple cysts (Fig. 4). The microdissection finding (diverticulum) as well the macroscopic cyst therefore seem to be acquired affections, and the diverticulum may be considered the precursor of the cyst.

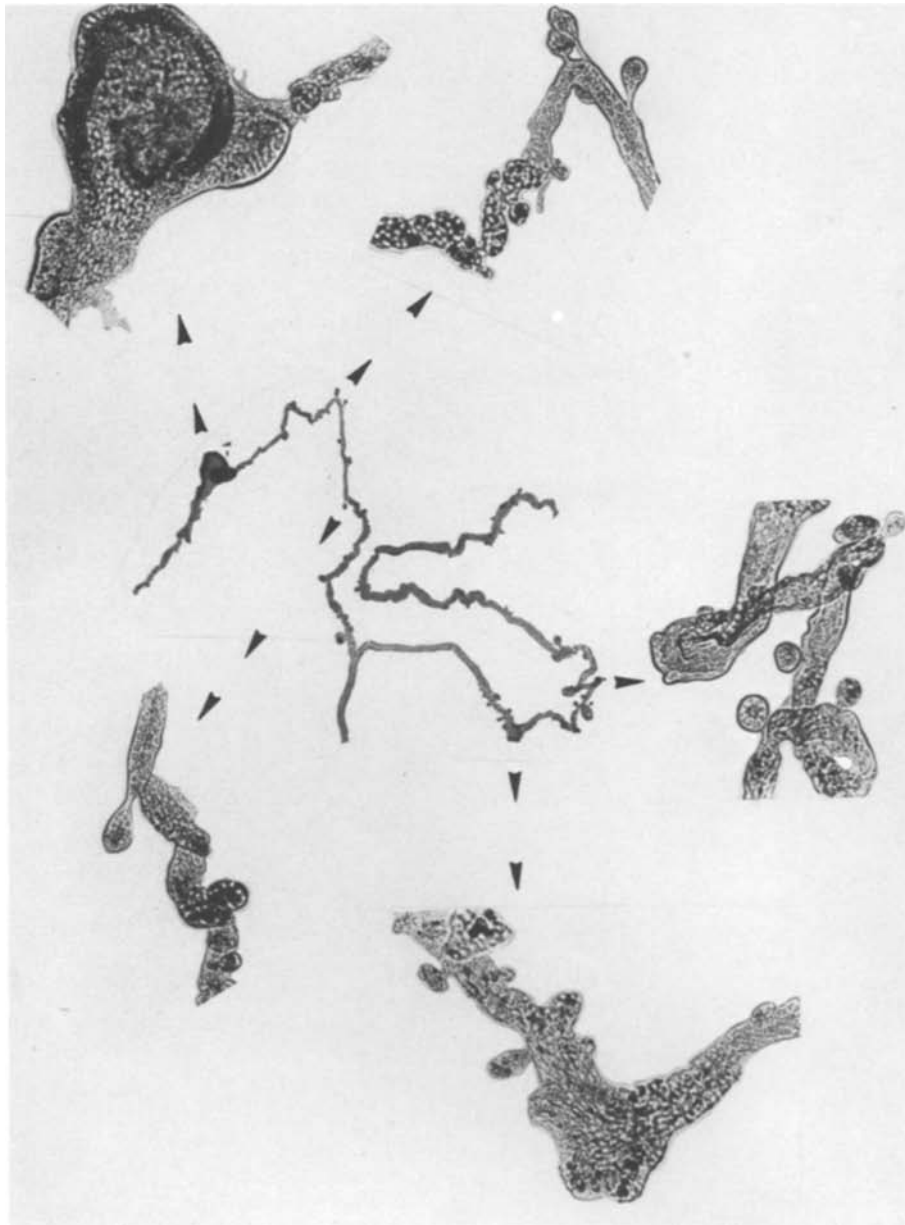


Fig. 6. Mosaic photomicrograph of portions of distal tubules from a 60-year-old man with ureteral obstruction and simple cortical cysts. Pedunculated diverticula and cystic ectasia of distal convoluted tubules. (x 23,45; details x 150)

The increasing numbers of diverticula on the distal convoluted tubule with age coincides with a process in which collagen and elastin, the constituents of the basement membranes of the tubules, lose their elasticity so that these supporting structures are weakened. Apart from degeneration which characterises this period in which diverticula and cysts occur, obstruction is common and may act as a possible precipitating factor.

A previously published study (8) showed that obstruction of the adult kidney produces diverticula as well as cysts on the distal convoluted

tubule, Henle's loop and collecting tubules. The microdissection picture is very similar to that of a kidney with simple cysts (Fig. 6).

The clinical study shows that the simple cysts occur mainly in the male and the exceptionally high incidence among patients presenting with prostatism suggests that obstruction may be an aetiological factor. The nephron and its system of collecting tubules are part of the excretory system in a broad sense and it is therefore understandable that this intrarenal tubular system is influenced by a retrograde pressure.

CONCLUSION

Diverticula on the distal tubule and the simple renal cyst appear to a large extent to be acquired. The simple cyst seems to be preceded by the appearance of diverticula on the distal tubule. Besides degenerative phenomena affecting the basal membranes in elderly patients, an obstructive factor, which is common in the elderly male should be considered.

Acknowledgements. Figure 5 is reproduced by kind permission of Prof. E. M. Darmady and the Editor of the Journal of Pathology 109, 195 (1973). My gratitude is due to Prof. E. M. Darmady, for the opportunity to acquaint myself with the technique of renal microdissection under his guidance.

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