

Table 2. Age Distribution of 155 Cases Bladder Cancer Coming from the BFD-endemic Area (registered data from 24 hospitals)

Age (yr)	Male	Female	Total
30-39	3	1	4
40-49	8	6	14
50-59	33 (36.7%)	21 (32.3%)	54
60-69	32 (35.6%)	27 (41.5%)	59
70-79	13	9	22
80-89	1	1	2
Total	90	65	155

Range : Male : 31-80 yr; Female: 37-81 yr.

have revealed strong evidence to support the high incidence of urinary cancer associated with arsenic in drinking water. Reports not only in the endemic area of Taiwan, but also in Japan,²⁸ Argentina,²³ and United States²⁴ support arsenic intoxication related to urinary cancer. In a study of the dose-response relationship between ingested inorganic arsenic and internal cancers, a total of 263 patients with BFD and 2293 healthy residents in an endemic area of arseniasis were recruited and followed up for 7 years. A dose-response relation was observed between long-term arsenic exposure from drinking artesian well water and the incidence of lung cancer, bladder cancer, and cancers of all sites combined after adjustment for age, sex, and cigarette smoking through Cox's proportional hazards regression analysis. Blackfoot disease patients had a significantly increased cancer incidence after adjustment for cumulative arsenic exposure.²⁵

An ecological study encompassing 243 townships in Taiwan was conducted to evaluate any further associations between arsenic ingestion and urinary cancer (between 1980 and 1987) of various cell types.²⁶ This study used the proportions of wells with various specified arsenic levels in each township as indicators of exposure and evaluated the effects of urbanization by an urbanization index. The result showed that high arsenic levels in drinking water were associated with transitional cell carcinomas of the bladder, kidney, and ureter and all urethral cancers combined. The authors also observed such associations in adenocarcinoma of the bladder in males, but not in squamous cell carcinomas of the bladder, or renal cell carcinomas or nephroblastomas of the kidney. There was also

Table 3. Cell Type of the 134 Cases of Bladder Cancer (registered pathological report from 24 hospitals)

Transitional cell carcinoma	120 (89.5%)
Squamous cell carcinoma	8 (6.0%)
Adenocarcinoma	6 (4.5%)
Total	134

a positive association between the urbanization index and transitional cell carcinoma of the ureter in males. These results indicate that the carcinogenicity of arsenic may be cell-type specific.

Clinical Characteristics of Urinary Cancer in the BFD Endemic Area

According to registered data of BFD endemic bladder cancer between 1981 and 1985, there were 155 cases of urinary bladder cancer diagnosed in 24 hospitals. In 90 males and 65 females, the most prevalent age of cancer occurrence was 50 to 69 in both sexes (Table 2). Pathological reports could be found in 134 cases, among which, 120 cases (89.5%) were transitional cell carcinoma, 8 cases (6.0%) were squamous cell carcinoma, and 6 cases were adenocarcinoma²⁷ (Table 3). The pathological picture of BFD endemic urinary cancers was quite different from that of endemic bladder cancer of North Africa. Where squamous cell carcinoma of urinary bladder is predominant, it was proved to be related to the endemic, chronic bilharzial infection.²⁸ The pathological feature of urinary cancers from the BFD endemic area was very similar to the non-endemic urinary cancers in Taiwan²⁹ and elsewhere in the world.³⁰

Other clinical studies also revealed that there is no significant difference between urinary cancers from the BFD endemic and other areas of Taiwan in a general clinical view such as patient's age, sex, cancer primary foci, or cancer cell differentiation. However, the staging of urinary bladder cancer from the BFD endemic area seems more invasive (66%, N = 30) than that of bladder cancer from other areas (30%-35%, N = 273) in a National Taiwan University Hospital series (1977-1989).²⁹ A poorer prognosis was seen in a Kaohsiung Medical College series (1972-1987) which showed the postoperative recurrence, invasion of bladder cancer from the BFD endemic area to be