effective charge of 0.3e on water protons.

A more detailed analysis on the effect of the charge on the hydrogen radius is in progress and the details will be reported later.

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SERUM ELECTROLYTES LEVELS IN RELATION TO THE PROGRESSION OF DIFFERENT TRANSPLANTED TUMOURS IN MICE MODEL SYSTEM

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ELECTROLYTES play an important role in cell division, cellular proliferative process as well as in other biological and biochemical functions[1–3]. The extra– and intracellular concentrations of electrolytes and their transport as well as intracellular sequestration system appeared to have immense role in the above process. Alteration of intracellular concentrations of sodium and potassium of different tumour cells has been documented[4]. However, there is hardly any report regarding the levels of serum electrolytes in relation to the progression of tumour. It is therefore, of considerable interest to examine the serum electrolytes in animal model system using different types of transplanted tumours with a view to understanding the relationship between the levels of serum electrolytes and the progression of different transplanted tumour systems following transplantation.

Normal Swiss mice of different tumour models were used for the study. The tumour involved Dalton's lymphoma (Lymphoma) Sarcoma-180 (S-180) and Ehrlich's carcinoma. The mice were 7–8 weeks of age with body weight ranging from 16 to 25 g (mean weight 20 ± 3.9 g).

Originally, lymphoma was found as a spontaneous thymal tumour of DBA mice and later this tumour line was maintained in the ascites form by serial *in vivo* transfer of tumour cells (1:1) in adult Swiss mice for a long time. S-180 and Ehrlich's carcinoma were also maintained in ascites form by serial *in vivo* transfer of tumour cells in adult Swiss mice.

Different batches of animals were used for the present experiments and the mice were given transplantation i.p. with 1×10^6 S-180, Ehrlich's carcinoma and lymphoma cells per mouse. Blood was collected from tumour-bearing mice by direct cardiac puncture on 5th, 10th and 20th day following transplantation of tumour cells under ether anesthesia. Serum was separated by centrifuging the blood at 500 g for 15–20 min. Blood was collected from normal Swiss mice following the same procedure on 5th, 10th and 20th day and served as controls. Serum levels of sodium and potassium were performed with flame photometer using commercial standards[5]. For statistical analysis, student's *t* test was done.

Levels of serum electrolytes in relation to the progression of different transplanted tumours exhibited interesting pictures (tables 1 and 2). However, progression of tumour was evaluated on the basis of tumour cell count during the days of tumour progression (table 3). It is evident from table 1 that

Table 1 *Serum sodium level (mmol/l in mice-bearing sarcoma-180 Ehrlich's carcinoma and lymphoma in relation to different days of tumour progression following transplantation of tumour cells*

Days of tumour progression	Sarcoma	Carcinoma	Lymphoma	Control
5th	145.2 ±6.17	120.12 ±4.9	112.04 ±6.29	142 ±3.2
10th	143.12 ±6.86	116.16 ±3.47	107.08 ±5.45	143.0 ±3.2
20th	143.32 ±7.91	110.04 ±4.0	101.2 ±4.2	143.12 ±4.39

The number of animals used is 25 and the values are mean ± SD.

Table 2 *Levels of serum potassium (mmol/l) in mice-bearing sarcoma-180 Ehrlich's carcinoma and lymphoma in relation to the progression of transplanted tumour cells*

Days of tumour progression	Sarcoma	Carcinoma	Lymphoma	Control
5th	8.24 ± 1.47	6.2 ± 3.04	10.62 ± 1.68	4.1 ± 0.968
10th	8.5 ± 1.8	6.9 ± 1.6	11.51 ± 2.8	4.18 ± 1.18
20th	9.5 ± 2.19	7.2 ± 1.9	12.176 ± 3.06	4.3 ± 1.89

The number of animals used is 25 and the values are mean ± SD.

Table 3 *Growth pattern of mice-bearing three different types of tumours*

Days of tumour progression	Sarcoma* ($\times 10^6$)	Carcinoma* ($\times 10^6$)	Lymphoma* ($\times 10^6$)
5th	6.1	5.9	6.9
10th	9.8	9.2	12.2
20th	12.5	13.1	13.5

*Average of 6 mice.

the level of serum sodium in mice-bearing carcinoma and lymphoma was found significantly lowered ($P < 0.01$) on the 5th day in comparison to the normal controls. Such a level gradually declined in relation to the progression of the tumour. Interestingly, the level of serum sodium of mice-bearing sarcoma did not show any change in comparison with that of control. However, serum potassium level (table 2) in mice-bearing sarcoma, carcinoma and lymphoma showed a different picture. Potassium level was found significantly increased ($P < 0.01$) on the 5th day in all the tumour following transplantation and such a level was found progressive till the 20th day of tumour progression. Among the three tumour models, the maximum increase was noted in lymphoma and least in carcinoma. From the results, it is clear that the serum sodium and potassium levels significantly varied for all the experimental groups. Hence the differences with respect to the levels of sodium and potassium in mice with three experimental tumour models have not yet been reported earlier.

Recent evidences have demonstrated hyponatremia in cat cell carcinoma and hypokalemia in carcinoma of colon as well as leukemic patients[6,7]. However, our investigations in the experimental tumour models distinctly reveal hyponatremia in mice-bearing lymphoma and carcinoma and hyperkalemia in all the three tumour models at the serum level.

Current studies on intercellular concentration of sodium in normal and transformed cells have revealed a significant increase of sodium in transformed cell types and such increase has been suggested to be linked with oncogenesis. However, potassium concentration in the transformed cells has been reported to be considerably decreased[8]. Such altered level of sodium and potassium in serum in experimental tumour model systems is not strange since alteration of intracellular concentrations of sodium and potassium is likely to influence the levels of extracellular electrolytes. Further studies are in progress to explore the intricate relationship in intra– and extracellular levels of electrolytes during tumorigenesis.

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