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Free Amino Acids and Related Compounds in the Fluid from Surgical Ciliated Cysts of the Maxilla

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Summary

Fluids from 6 surgical ciliated cysts of the maxilla and autologous sera were analyzed for total free amino acids and related compounds concentrations. All of the amino acids present in the serum were observed in the cyst fluids, but the concentrations and profile of their constituents were markedly different from that of the serum. The concentrations of non-essential amino acids such as Ala, Glx, and Gly were extremely low in the cyst fluids. The composition and concentration of the amino acids and related compounds in the fluids of these cysts may reflect the balance between proteolytic and catabolic metabolism and also in the permeability effect of the lining cells of the cyst wall.

INTRODUCTION

Biochemical studies on cyst fluid have been carried out to elucidate the nature and metabolism of their constituents. They contain proteins (Toller, 1970,[19] Skaug and Hofstad, 1973,[10] Skaug, 1973[11],[12]) including lactate dehydrogenase isozyme (Kapitany, 1974[6]) electrolytes, lipids (Suzuki, 1975[16], Stokke, 1976[15]), cholesterol (Browne, 1971[2]) lipoproteins (Skaug, 1976[13]), carbohydrate (Skaug and Hofstad, 1977[14]) and the transport mechanism of radioactive sodium ion and human serum albumin (Toller, 1967[18]). However, their has not been reported the composition of free amino acids in the fluid of a cyst.

Surgical ciliated cysts of the maxilla were reported by Gregory and Shafer[4] in 1958. The cyst developed after previous surgical entry into the maxillary sinus during a Caldwell-Luc operation. The same clinical cases were reported by Kubo(1933[7]) in Japan. He named it "Wangenzyste nach Radikaloperation der Sin. max. chron. (Kubo)" which is frequently used. According to his report the cyst developed several years after a radical operation of the maxillary sinus.

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The abbreviations used are: P-Ser, phospho-Ser; Tau, taurin; P-EtA phospho-ethanolamine; Cit, citrulline; α-AnBa, α-amino-n-butyric acid; Ans, anserine.

The aim of the present work is to identify and quantify the free amino acids and related compounds in the cyst fluids and autologous sera which are related to the metabolism of the epithelium lining the cyst.

MATERIALS AND METHODS

The cyst fluids from 6 patients who had had a operation several years ago in the maxillary sinus were collected by means of a syringe pressure reduction being avoided by supplying air through another syringe at the same time. The cyst fluids were centrifuged at 10,000 x *g* for 30 min at 4°C. When the fluid was viscous and no supernatant separated, it was suspended in a suitable volume of saline and centrifuged at the same speed. Blood from the 6 patients was drawn from the antecubital vein. The sera were separated from the blood by centrifugation at 3,000 x *g* for 20 min. After precipitating the protein by adding 1.5 vol of 5% sulphosalicylic acid they were removed by centrifugation. The deproteinized solutions were diluted with 0.3 M Li-citrate buffer pH 2.73 before analysis by an automatic amino acid analyzer (JEOL 6AH equipped with JEOL-DK digital integrator) with the dual column system[1] and compared with a standard amino acid mixture (WAKO PURE CHEM. IND, LTD.).

Total protein concentration was estimated by the Lowry method[8] using bovine serum albumin as the standard.

RESULTS AND DISCUSSION

The free amino acids found in both cyst fluids and autologous sera of the 6 patients are summarized in Table 1 and arranged in decreasing order of their concentrations in Fig. 1. The concentration of protein, and urea in the fluid of cysts and autologous sera are summarized in Table 2.

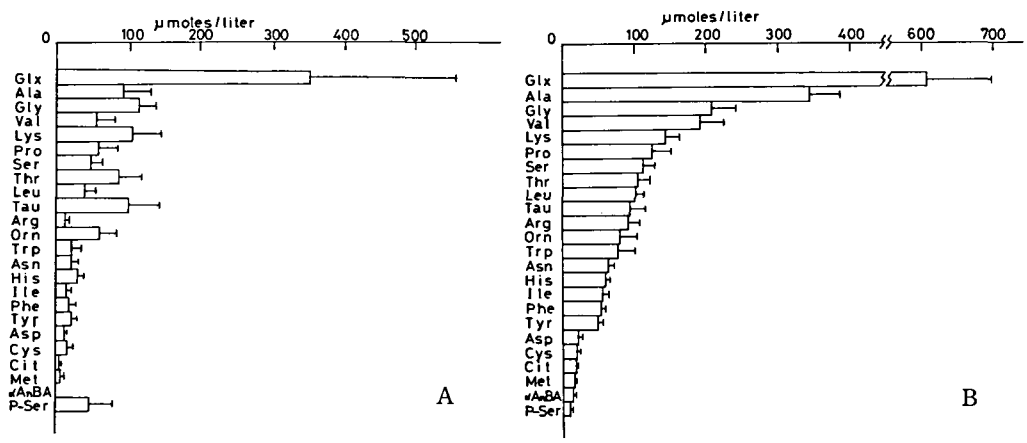

Fig. 1 Free amino acid and ninhydrin-positive substance concentrations in the six fluids from surgical ciliated cysts of the maxilla and autologous serum (Mean±S. E.). A: Cyst fluid: B: Serum

Table 1 : Free amino acid and ninhydrin-positive substance concentrations in surgical ciliated cyst and autologous serum

Sex, Age	m33		m43		m44		f38		f47		f59		Serum		Cyst fluid	
Amino acid (μ mole / liter)	Serum	Cyst	Serum	Cyst	Serum	Cyst	Serum	Cyst	Serum	Cyst	Serum	Cyst	Mean	±S. E.	Mean	±S. E.
Orn	48	49	70	9	307	75	47	149	32	6	29	77	80	24	61	22
Lys	63	56	167	14	157	174	144	243	65	9	43	140	143	20	106	39
His	29	12	56	Tr	94	56	60	53	81	Tr	27	57	60	6	30	9
Ans	ND	ND	ND	ND	45	236	ND	ND	ND	ND	Tr	Tr	Tr		Tr	
Trp	1	ND	19	Tr	228	90	62	Tr	19	Tr	8	11	78	23	Tr	
Arg	34	21	47	Tr	148	46	60	Tr	47	Tr	14	13	91	17	13	6
P-Ser	2	5	29	4	11	198	3	31	3	42	3	3	10	3	47	31
Tau	30	94	72	7	282	111	71	299	59	67	22	28	94	21	101	43
P-EtA	ND	ND	ND	ND	ND	Tr	Tr	Tr	ND	ND	11	Tr	Tr		ND	
Asp	5	8	22	13	78	ND	8	32	11	6	15	14	21	6	12	4
Thr	48	58	116	16	141	107	107	220	40	8	3	105	104	17	86	32
Ser	53	41	114	19	215	31	109	111	54	8	49	80	112	16	48	16
Asn	21	21	64	ND	75	Tr	68	42	19	ND	68	62	64	8	21	11
Glx	315	181	422	54	837	214	452	1379	362	15	67	256	607	93	350	209
Pro	16	49	126	ND	167	ND	84	193	17	ND	74	108	124	27	58	26
Gly	86	56	162	140	454	30	324	191	86	130	87	137	208	34	114	24
Cit	ND	ND	23	19	9	Tr	22	Tr	ND	ND	11	11	19	2	Tr	
Ala	230	69	444	ND	625	71	448	164	225	8	259	243	345	44	93	39
α-AnBA	21	ND	10	Tr	7	ND	7	Tr	27	ND	8	5	14	3	Tr	
Val	78	23	278	Tr	177	40	235	118	81	7	104	144	192	25	55	25
Cys	13	34	Tr	ND	ND	ND	36	39	12	Tr	16	25	20	4	16	8
Met	7	ND	12	Tr	7	28	20	ND	7	ND	10	16	16	2	Tr	
Ile	22	7	74	Tr	49	39	57	9	27	6	35	31	56	8	15	6
Leu	35	10	136	6	110	36	108	62	43	10	53	108	101	13	39	16
Tyr	22	10	54	Tr	42	46	54	27	17	Tr	35	51	49	7	22	7
Phe	27	Tr	61	ND	77	34	59	33	33	Tr	25	49	55	6	19	9

m : male f : female ND : not detected Tr : trace amount

All the amino acids present in the sera were also found in the cyst fluids except α-AnBA, but the total concentrations in the cyst fluids were almost one-half those in the sera. In particular, the concentration of non-essential amino acids, such as Ala, Glx, and Gly was extremely low. The Glx concentration showed the most individual variation, with the highest concentration. Relatively high concentrations of Tau indicated the high metabolic activity of taurocholic acid[9] or sulphur amino acids[3] in this tissue. No Hyp and Hyl were detected in any of the fluids.

Table 2 Free amino acid and related substance concentrations in cyst fluid and autologous serum. (Mean±S. E., n=6)

	Total Amino Acid*	Urea*	Total Protein**
Cyst fluid	1,376±526	2,182±683	85.9±17.2
Serum	2,725±354	4,115±537	83.0±1.4

* Results expressed in μ moles per liter
** Results expressed in mg per ml

As ninhydrin positive subustances the concentration of urea was almost one-half as much as that of the sera. The urea in the fluids therefore may be derived from the sera, passing through the lining membrane of the cyst. Total protein concentration in the cyst was almost at the same level as that of the serum.

On the analysis of carbohydrates and glycoproteins in fluid from non-keratinizing jaw cyst, it was found that free glucose in the cyst fluid was one-half of the concentration in the serum and the high levels of fucose in the cyst fluid suggested the presence of fucomucine in the cyst fluid.[14] Such a reduction of glucose and amino acids concentration in the cyst fluid indicated that they may be used for the gradual proliferation and maintenance of the cyst.

The diffusing rate of the radio-active Na^+ was more rapid than that of the radio-active human serum albumin within the lumen of a dental cyst.[18] The lining of the cyst probably varies in its permeability to amino acids which produces the different profile of amino acids in the cyst. On the radicular cyst, though there were only two cases, total amino acids concentration in the fluid was higher than that of the surgical ciliated cyst, but the quantitative profiles fairly resemble each other (Hiraoka et al., unpublished result).

Kaneko[5] reported that the hexosamine content in the postoperative buccal cyst was higher than that of the follicular dental cyst, radicular cyst and nasopalatine cyst. The material secreted from the epithelial cells probably constitutes a part of the cyst fluids. Suzuki[17] analysed the lipids in postoperative buccal cysts and concluded that they consisted of serum lipids in different properties. This may relate to the selective transport and the secretion epithelial cells.

We conclude that the unique amino acid composition of the cyst fluid reflected the balance between proteolytic and catabolic metabolism of the lining cells affected by the permeability of the membrane.

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