— Note —

Biological Characteristics of *Staphylococcus aureus* Isolated from Nude Mice

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The characteristics of 50 strains of *Staphylococcus aureus* isolated from BALB/c nude mice (*nu/nu*, *nu/+*) with or without subcutaneous abscesses [13] were examined. All the 50 strains belonged to biotype B according to the classification by Hájek and Maršálek. All of them were phage typable, showing a single phage pattern of 52A/79/47/53/77/83A/85. The coagulase type was classified as VII. All of the 50 strains were highly sensitive to penicillin, methylphenylisoxazolyl penicillin, erythromycin, spiramycin, lincomycin, chloramphenicol, tetracycline, kanamycin, gentamicin and cephaloridine, but were resistant to sulfisoxazole. Two *S. aureus* strains isolated from the nostril and finger of one person working in the mouse colony were identified as the same biotype as the murine strains but different in phage type, coagulase type and drug resistance pattern.

There have been several reports of outbreaks of staphylococcal infection such as furunculosis [2, 9] and dermatitis [10] due to *Staphylococcus aureus* in nude mice, but the detailed characteristics of the isolated *S. aureus* have not been reported. We have encountered an epizootic of dermal abscess formation appearing mainly on the facial and mandibular areas of nude mice (BALB/c background) in a colony, and *S. aureus* was isolated from the abscesses and other sites [13]. This colony was developed in the National Institute of Public Health originating with 5 *nu/nu* males and 10 *nu/+* females from a commercial breeder. Forty strains of *S. aureus* isolated from

the affected and healthy mice at ages of 2 to 6 months and 10 strains from 4 weeks old female *nu/nu* mice newly purchased from the above breeder were examined in detail for their characteristics in order to confirm the etiological significance of *S. aureus* in the abscess formation and also to compare the biological characteristics of the strains with other murine isolates we have examined previously [16]. All the *Staphylococcus* strains were picked up from colonies developed on egg yolk-added mannitol salt agar (Eiken K.K., Tokyo) which was smeared directly with specimens. Yolk reaction positive colonies were dominant in the primary cultures of the specimens as reported

previously [13]. Two *S. aureus* strains isolated from the nostril and finger of a worker who engaged in taking care of the colony were also examined to see whether a contamination with *S. aureus* occurred from the worker. Among the 50 murine isolates, 36 strains were from the facial skin (n=10), oral cavity (n=9), feces (n=8) and subcutaneous abscesses (n=9) of 9 abscess-bearing *nu/nu* mice and 4 from the feces of 4 abscess-free *nu/+* mice. The remaining 10 strains were from the facial skin of 10 newly purchased healthy *nu/nu* mice.

All of the 50 murine strains showed the same biological characteristics. The methods used for these biological tests have been described elsewhere [16]. They coagulated both rabbit and human plasmas, but not bovine plasma, within 24 hours. The strains were clumping factor positive, produced yellow pigment, heat-stable and heat-labile deoxyribonucleases, phosphatase, urease, protease, acetoin and protein A (using heart infusion agar plates containing 1% normal dog serum [6]), hydrolyzed egg yolk and Tween 80, reduced nitrate, produced positive-type (yellow) colonies on crystal violet agar and grew on medium with 10% NaCl. All of them failed to produce hemolysins (rabbit and sheep erythrocytes), gelatinase and fibrinolysin. All the mouse strains produced acid aerobically from fructose, galactose, glucose, glycerol, lactose, maltose, mannitol, mannose, sucrose and trehalose, but not from arabinose, dextrin, inulin, raffinose, salicin, sorbitol and xylose. The two human strains were different in some of the above characteristics from the mouse strains. They produced gelatinase and α -hemolysin but not protein A. All the murine and human strains belonged to biotype B according to the classification by Hájek and Maršálek [4].

All the strains were phage typable with the international set for typing human *S. aureus*. The typing was made as described by Shimizu [14], and strains showing strong lysis, more than 50 plaques to confluent lysis, were recorded as typable. All of the murine strains were group I+III and the two human strains I+II+III (Table 1). Coagulase typing was performed according to the method of Ushioda *et al.* [18]. Coagulase-type-specific rabbit antisera

Table 1. Phage patterns of 52 *S. aureus* isolates with human typing phages*

Origin	Phage pattern	No. of typable isolates
Nude mouse	52 A/79/47/53/77/83 A/85**	50
Human	29/52/52 A/79/80/3 A/55/71 42 E/54/75	2

* Typing phages used were 29, 52, 52 A, 79, 80, 3 A, 3 C, 55, 71, 6, 42 E, 47, 53, 54, 75, 77, 83 A, 84, 85, 81 and 187.

** Phage typing was performed only at 100 x routine test dilution.

(I to VIII) were purchased from Denka Seiken Co. Ltd., Tokyo, Japan. The murine strains belonged to coagulase type VII, the human strains to type I. Drug susceptibility tests were made using the disc-diffusion method (Tridisc, Eiken K. K., Tokyo) at 3 concentrations. All of the mouse strains were highly sensitive to penicillin, methylphenylisoxazolyl penicillin, erythromycin, spiramycin, lincomycin, chloramphenicol, tetracycline, kanamycin, gentamicin and cephaloridine, but resistant to sulfisoxazole. The human strains showed resistance to erythromycin, spiramycin, lincomycin and sulfisoxazole.

The biological properties, coagulase type, phage type and antibiogram of the *S. aureus* strains isolated from the abscesses of *nu/nu* mice and from their facial skin and digestive tract were all identical. Further, the same characteristic *S. aureus* was found from the feces of *nu/+* mice of the colony as well as from facial skin of the normal *nu/nu* mice of the mouse breeder. These results strongly suggest that the present outbreak of abscesses is due to an epizootic association of the particular type of *S. aureus* in the mouse colony. It appeared that the *S. aureus* strain had colonized on the body surface and in the alimentary tract, and produced abscesses when the organisms invaded tissues of athymic *nu/nu* mice. It has been reported that *S. aureus* of the same phage pattern as the present strains was found in furunculosis of nude mice (Ishiguro *et al.*, The 33rd Scientific Meeting of Japanese Association for Laboratory Animal Science, Tokyo, 1986).

The present murine isolates were different in their biological characteristics from the previously reported murine strains which were associated with dermatitis in an ICR strain of mice [16]. Although *S. aureus* has been reported to be isolated from a variety of common laboratory animals with or without lesions [1, 3, 5, 7, 8, 11, 12, 15], no satisfactory study has been reported on their precise characteristics. The present and previous findings [16, 17] indicate that various biotypes of *S. aureus* may be causal agents of murine staphylococcosis.

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スードマウスから分離された *Staphylococcus aureus* の生物学的性状について

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BALB/c系スードマウスの皮下膿瘍発症9例(*nu/nu*)の膿瘍内容物, 顔面皮膚, 口腔, 糞便および非発症4例(*nu/+*)の糞便ならびにこれらのマウスの由来元である繁殖施設から新たに購入した非発症 *nu/nu* マウス10例の顔面皮膚から分離した黄色ブドウ球菌50株について, 各種性状を調べた。分離株は全て同一の生物型 (Hájek & Maršálek のB型), フェージ型 (I + III群), コアグ

ラーゼ型 (VII型) を示し, 薬剤耐性パターン (SX 耐性) も同一であった。また, 本マウスコロニーの飼育に関係したヒト1例の鼻前庭・手指から2株の該菌を分離し, 上記性状を比較したところ, マウス株と同じ生物型に属したが, フェージ型 (I + II + III群), コアグラーゼ型 (I型), 薬剤耐性型 (EM/SPM/LCM/SX 耐性) および 2, 3の生物性状において, マウス株と異なっていた。