Catheter Infection Caused by an Unusual Pathogen, 
Agrobacterium radiobacter

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The genus Agrobacterium is composed of several phytopathogenic species occurring worldwide in soils. One 
nontumorigenic species, Agrobacterium radiobacter, has occasionally been isolated from clinical specimens, but 
its pathogenic role in these cases has been difficult to ascertain since agrobacteria are usually isolated in 
association with other bacteria. We report the case of a central venous catheter infection and present the 
characteristics of A. radiobacter.

The genus Agrobacterium contains several plant pathogens, and species are assigned according to their phyto-
pathogenic effects (8, 11, 20). Three distinct species are recognized: A. tumefaciens (=pathovar of A. radiobacter), A. rhizogenes, and A. rubi; a fourth cluster of yellow-pigmented isolates has been tentatively designated the "Ag-
robacterium yellow group" (20). The strains that cause crown gall are associated with A. tumefaciens, and those 
that cause hairy root disease are referred to as A. rhizogenes (8, 11). Strains that cause cane gall on Rubus spp. have been 
designated A. rubi (8, 11); agrobacteria which are not phytopathogens have been referred to as A. radiobacter (8, 11), 
although no morphological, physiological, or biochemical differences could be observed between strains of A. radi-
obacter and A. tumefaciens (4, 6, 8, 11, 15).

Agrobacteria have occasionally been isolated from clinical 
specimens and classified as Vd-3 bacteria (18); nevertheless, 
only a few human infections have been reported (2, 16, 20, 
23).

We report here a further case of infection involving A. 
radiobacter and present the characteristics of the organism.

A 14-month-old male hospitalized in our institution since 
his birth was evaluated for fever. He had undergone several 
intestinal resections for extensive Hirschprung’s disease. 
Because of his short bowel syndrome, he was treated by 
total parenteral nutrition through a central venous catheter 
(CVC) placed 3 months earlier. Following a protocol used in 
our hospital to evaluate these catheters in febrile patients 
with CVCs (21, 22), the total parenteral nutrition team 
collected blood from the CVC for semiquantitative culture 
(SQCBC). For vascular reasons peripheral blood cultures 
could not be obtained at that time.

After 48 h of incubation, the SQCBC showed confluent 
growth of a gram-negative bacterium later identified as A. 
radiobacter. Since the vascular accesses of the child were 
quite scarce, it was decided to attempt antibiotic therapy 
through the catheter (7). Different antibiotics (ceftriaxone 
and amikacin, ticarcillin, and then imipenem plus cilastatin) 
were tried in this attempt, each time with negative SQCBC 
and improvement of the child. However, several days later, 
the SQCBC once more became positive with the same 
bacterium. At the last trial (with imipenem and cilastatin), 
the child was febrile and clinically unwell at the time the 
SQCBC showed a reappearance of A. radiobacter, so that 
removal of the catheter was judged mandatory.

The CVC was finally removed when the child had received 
a second course of imipenem plus cilastatin through it for 3 
days; the culture of the CVC was negative, and the child 
improved. The new CVC, which had to be placed for 
vascular reasons close to the site of the previous one, was 
bacteriologically monitored by frequent SQCBCs, which 
remained sterile. All the control cultures performed at 
the insertion site of the catheter were negative. All total par-
ental nutrition bags had been routinely cultured and were 
always sterile. A. radiobacter was never isolated in our 
institution from any other patients or sites. Its origin in this 
case remains undetermined.

Biochemical tests were performed by the methods of 
Gilardi (3), Hansen and Youssowsky (5), Hugh (9), and 
Rubin et al. (19); the production of 3-ketolactose from 
lactose was investigated by the method of Bernaerts and De 
Ley (1).

All the strains isolated from our patient shared the same 
features typical of the genus Agrobacterium (8, 11), as 
presented in Table 1. Since the 3-ketolactose test was 
positive, the strains may be considered to belong to biovar 1 
according to Kersters and De Ley (11), which corresponds 
to biotype 1 of Keane et al. (10).

The antibiotic susceptibility patterns of all isolates tested 
by a conventional diffusion method on Mueller-Hinton agar 
were identical. The strains demonstrated susceptibility to 
ticarcillin, amoxicillin-clavulanic acid, tetracycline, 
polyoxin B, cefuroxime, cefotaxime, ceftriaxone, trimetho-
prim-sulfamethoxazole, gentamicin, tobramycin, amikacin, 
etnamicin, norfloxacin, and imipenem; resistance to penicil-
lin, ampicillin, pipercillin, and cefazolin was observed.

Agrobacteria are environmental bacteria occurring in 
soils, particularly in the rhizospheres of plants. With the 
exception of A. radiobacter, members of the genus Agro-
bacterium are plant pathogens, invading the crown, roots, 
and stems of various dicotyledonous and some gymnosper-
mous plants via wounds, transforming the plant cells into 
autonomously proliferating tumor cells (11). Tumor induc-
tion by Agrobacterium spp. is correlated with a tumor-
inducing Ti plasmid in the bacterial cell. Strains without Ti 
plasmids are not phytopathogenic and should be named, 
according to Kersters and De Ley, A. radiobacter (11). 
Except for phytopathogenic effects and the presence of a Ti 
plasmid, A. radiobacter is indistinguishable from A. tume-

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**TABLE 1. Biochemical characteristics of strains isolated in the present case and comparison with results reported by Rubin et al. (19)**

<table>
<thead>
<tr>
<th>Test or substrate</th>
<th>Reaction with field strains</th>
<th>% Positive predicted*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cytochrome c oxidase</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>Motility</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>Acid from:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>Fructose</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>Malate</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>Xylose</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>Mannitol</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>10% Lactose</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>3-Ketolactose production</td>
<td>+</td>
<td>100b</td>
</tr>
<tr>
<td>Growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On MacConkey agar</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>On salmonella-shigella agar</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>In 6.5% NaCl broth</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Nitrate reduction</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>Gas from nitrate</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Urease</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>Indole production</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Lysine decarboxylase</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Ornithine decarboxylase</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Arginine dihydrolase</td>
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<td>0</td>
</tr>
<tr>
<td>Alkaline phosphatase</td>
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<td>ND</td>
</tr>
<tr>
<td>Hydrogen sulfide production</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>Esculin hydrolysis</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Tributyrine hydrolysis</td>
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<td>ND</td>
</tr>
<tr>
<td>α-D-Galactosidase</td>
<td>+</td>
<td>ND</td>
</tr>
<tr>
<td>β-D-Galactosidase</td>
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<td>ND</td>
</tr>
<tr>
<td>β-Xylosidase</td>
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<td>ND</td>
</tr>
<tr>
<td>α-D-Glucosidase</td>
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<tr>
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<tr>
<td>N-Acetyl-β-D-glucosaminidase</td>
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<tr>
<td>β-D-Gluconidase</td>
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<tr>
<td>Starch hydrolysis</td>
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</tr>
<tr>
<td>Tween 80 hydrolysis</td>
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</tr>
<tr>
<td>Lecithin hydrolysis</td>
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</tr>
<tr>
<td>DNase</td>
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<tr>
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<td>100</td>
</tr>
<tr>
<td>Citrate alkaline</td>
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</tr>
<tr>
<td>Acetamide alkaline</td>
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<tr>
<td>Malonate alkaline</td>
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<td>ND</td>
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<tr>
<td>Phenylalanine deaminase</td>
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<td>100</td>
</tr>
<tr>
<td>Alanine aminopeptidase</td>
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</tr>
<tr>
<td>Pyrrolidonyl aminopeptidase</td>
<td>+</td>
<td>ND</td>
</tr>
<tr>
<td>γ-Glutamyl aminopeptidase</td>
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<td>ND</td>
</tr>
<tr>
<td>Leucine aminopeptidase</td>
<td>+</td>
<td>ND</td>
</tr>
<tr>
<td>Cystine aminopeptidase</td>
<td>+</td>
<td>ND</td>
</tr>
</tbody>
</table>

* Percentage of positive reactions as listed by Gilardi (3).
* According to Rubin et al. (19).
< ND, Not done.

faciens (11, 12). Since these bacteria are mostly associated with soil and plants, their isolation from clinical specimens is very rare. Nevertheless, Lautrop identified and characterized 10 isolates from clinical material (14); and Kiredjian isolated 10 other strains from blood, cerebrospinal fluids, and urine of human origin (13). Furthermore, Riley and Weaver, who studied Vd-3 bacteria from medical specimens and compared those isolates to strains of Agrobacterium, concluded that these bacteria were identical to *A. radiobacter* (18). Further strains of agrobacteria from clinical material were also characterized by Popoff et al. (17). In all these reports, the agrobacteria were usually isolated in association with other bacteria and therefore were considered to be contaminants; even when isolated in pure culture in some cases, no evidence that these organisms were pathogens was found. In only two reports, a case of prosthetic valve endocarditis and another of septicemia, were *Agrobacterium* spp. considered pathogens (2, 16).

It also has to be pointed out that significant cases of peritonitis caused by the *Agrobacterium* yellow group, a cluster of yellow-pigmented strains in the genus *Agrobacterium* (8, 20), in patients undergoing ambulatory peritoneal dialysis have been reported by Swann et al. (20).

Finally, it has to be mentioned that *A. radiobacter* was recently isolated from a culture of blood from a 20-year-old neutropenic woman (23); in this case, the Hickman line inserted into the right external carotid vein was considered to be the vehicle.

In our case, the repeated isolation of *A. radiobacter* from the CVC and an improvement after the catheter was removed strongly suggest colonization of the catheter lumen; some similarities between our observations and the case reported by Wilson et al. (23) are evident.

Since agrobacteria present particular susceptibility patterns, identification of these bacteria and distinction from other nonfermenters, especially *Pseudomonas, Alcaligenes*, and *Bordetella* spp. and *Achromobacter* group Vd, seem to be important. Conventional biochemical tests, such as rapid hydrolysis of urea and esculin and multiple clear-cut glycosidase activities (β-D-galactosidase and others) listed in Table 1, are very helpful. As previously pointed out by Freney et al. (2), *Agrobacterium* spp. are certainly organisms that may be added to the growing list of opportunistic bacteria.

**LITERATURE CITED**