Klebsiella: Taxonomy, nomenclature, and communication

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SUMMARY Differences in the delineation of *Klebsiella* spp. in the United Kingdom from that in the majority of other countries is discussed. An attempt is made to trace and interpret the reasons for these differences and suggestions are made for a rapid resolution of this problem which hazards communication.

Cowan (1974), in a brief review of the taxonomy of the genus *Klebsiella*, recognised seven named species, viz, *Klebsiella aerogenes*, *K. oxytoca*, *K. edwardsii*, *K. atlantae*, *K. pneumoniae* (*sensu stricto*), *K. ozaenae*, and *K. rhinoscleromatis*. However, Ørskov (1974), in *Bergey's Manual of Determinative Bacteriology* (8th edition), described only three species including *K. ozaenae*, *K. rhinoscleromatis*, and *K. pneumoniae* (*sensu lato*) which embraced those species, *K. aerogenes*/*oxytoca*/*edwardsii*/*atlantae*, demonstrated by Bascomb *et al.* (1971) to form a single large cluster of wide spectrum. Ørskov (1974) did not include *K. pneumoniae* (*sensu stricto*) which Bascomb *et al.* (1971) believed on traditional taxonomic grounds could be defined as a separate taxon.

At present publications in many United Kingdom medically orientated journals tend to use the binomial *K. pneumoniae* (*sensu stricto*) to describe Friedlander's bacillus, and to refer separately to *K. aerogenes*, *K. oxytoca*, *K. edwardsii*, and *K. atlantae* which fall within the species *K. pneumoniae* (*sensu lato*) exclusively referred to in American and many Western European journals. Some British hospital scientists (Barr and Mahood, 1977) accept the close association of several *Klebsiella* species and refer to *K. aerogenes*/*oxytoca*/*edwardsii*/*atlantae* as an identifiable group which, on the basis of Bascomb's study (Bascomb *et al.*, 1971), would be adequately described as *K. aerogenes*. This would result in the definition of two species, *K. aerogenes* and *K. pneumoniae* (*sensu stricto*), in United Kingdom clinical bacteriology literature, in conflict with a single species, *K. pneumoniae* (*sensu lato*), in other European, and American, literature.

Few workers would quarrel with the definition of *K. aerogenes* suggested by the numerical taxonomic work of Bascomb *et al.* (1971), but I suspect that the acceptance of *K. pneumoniae* (*sensu lato*) to include all *Klebsiella* biotypes not included in the species *K. ozaenae* or *K. rhinoscleromatis* may not be readily accepted in hospital communication here or, on the basis of the study of Bascomb *et al.* (1971), be justified.

The acceptance of a 'natural' classification of *Klebsiellas* based on numerical taxonomic investigation seems desirable, and evidence to support an artificial classification, which would uphold the species delineated by Cowan *et al.* (1960), and Cowan (1974) on a basis of differential invasiveness or pathogenicity, does not at present seem well justified.

Many medical microbiologists would advocate the retention of the binomial *K. pneumoniae* (*sensu stricto*) on the assumption that characteristic isolates are commonly respiratory pathogens while characteristic isolates of *K. aerogenes*, as delineated by Cowan (1974), generally do not have this property. Although Freeman (1974) and Barr and Mahood (1977) have encouraged the development of laboratory methods to distinguish especially *K. pneumoniae* (*sensu stricto*) from other members of the *K. aerogenes*/*oxytoca*/*edwardsii*/*atlantae*/*pneumoniae* group, Noone and Rogers (1976) illustrated the potential errors in this approach by demonstrating the incidence of pneumonia associated with opportunistic infection with *K. aerogenes* also.

Fallon (1974), however, suggested that, of the *K. aerogenes*/*oxytoca*/*edwardsii*/*atlantae* group, significant differences in pathogenicity could be associated with different species identified by the methods described by Cowan and Steel (1961). He suggested, in agreement with Foster and Bragg (1962), that *K.*

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edwardsii was more frequently associated with severe disease than other species, attributed a similar pathogenicity to *K. atlantae*, and described in his study the relatively infrequent association of *K. aerogenes* in such cases (see Darrell and Hurdle, 1964). Fallon (1974) emphasised in this work the association between colonial form, particular *Klebsiella* spp. and pathogenicity. However, this seems to be a dangerous premise in view of the demonstration by Bascomb *et al.* (1971) that *K. aerogenes/oxytoca/edwardsii/atlantae* form a single large cluster, each species showing insufficient homogeneity to form a separate taxa. In the light of this heterogeneity, demonstrated further in the definition of numerous biotypes of *Klebsiella* by Rennie and Duncan (1974), it seems presumptuous to ascribe especial pathogenicity to a single species within the group *K. aerogenes/oxytoca/edwardsii/atlantae* on the basis of colony characteristics alone. Clearly, however, such empirical evidence, provided by an experienced observer, may prove useful to the clinician before full biochemical typing of an isolate is obtained. At present, therefore, there seems insufficient cause to maintain those *Klebsiella* biotypes previously delineated as *K. aerogenes*, *K. oxytoca*, *K. edwardsii*, and *K. atlantae* as individual species on any bases of differential pathogenicity.

It seems clear that at this time classification of the genus *Klebsiella* is best fulfilled by the numerical taxonomic study of Bascomb *et al.* (1971) although this leaves unresolved the conflict arising from widespread use of the binomial *K. pneumoniae* (*sensu stricto*) in the United Kingdom and *K. pneumoniae* (*sensu lato*) in most other countries. This conflict, already present in the literature, is compounded by the increasing use in this country of commercially available kits for the identification of Enterobacteriaceae which recognise only those *Klebsiella* species described by Ørskov (1974) in *Bergey's Manual of Determinative Bacteriology* (8th edition).

The necessity for a resolution of this problem is clear. Clinical bacteriologists in the United Kingdom could, on the basis of the published classification of Ørskov (1974) and the numerical taxonomic study of Bascomb *et al.* (1971), reasonably be expected to adopt the European and American usage of the binomial *K. pneumoniae* (*sensu lato*) to include *K. aerogenes/oxytoca/edwardsii/atlantae/pneumoniae* and retain the ability to refer independently to Friedlander's bacillus as *K. pneumoniae* (*sensu stricto*). Although this diverges somewhat from the proposals of Bascomb *et al.* (1971) in not recognising *K. aerogenes* distinct from *K. pneumoniae* (*sensu stricto*), acceptance of this scheme would be in general agreement with their study, hasten the adoption of an essentially correct 'natural' classification, and aid

communication without misunderstanding among bacteriologists in different countries. This progress would precede the proposed revision of the International Code of Nomenclature of Bacteria in January 1980.

Recognition of biotypes of *K. pneumoniae* (*sensu lato*) should not be influenced by this controversy. Biotypes have been, and will continue to be, recognised (Rennie and Duncan, 1974) which include many with characteristics typical of those species recognised by Cowan (1974). The alliance of numerical biotyping (Rennie and Duncan, 1974) with capsular serotyping, bacteriocine typing or phage typing may provide for the recognition of biotypes of varying degrees of pathogenicity in a manner more communicable than that at present adopted.

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