Current Problem Cases

Fractures of the Dens and Risk of Pseudarthrosis

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Summary. This study deals with 49 fractures of the dens treated at the Orthopedic Department of Athens University during the past 17 years. These fractures represent 14.2% of all cervical fractures treated during the same period at our department. Forty-one cases have been reviewed and analyzed, the average follow-up time being 10 years (1-16). Pseudarthrosis was found to be present in seven cases (17%), and its relationship to different factors was examined. The type of fracture and particularly the direction of the fracture line were found to be major factors leading to pseudarthrosis. Many other factors, such as displacement, traction, the stability obtained, the presence of associated injuries, and the time elapsed till treatment was started, as well as the age of the patients, seem to play – alone or in combination – important roles in the development of pseudarthrosis. These factors have been classified according to their importance and graded. With a total of 10 points or more a dens fracture is characterized as a fracture “at risk of pseudarthrosis”, i.e., a fracture with a higher possibility of developing a pseudarthrosis. This knowledge may contribute to proper and earlier management of such an injury.

Material

This study deals with 49 fractures of the dens treated at the Orthopedic Department of Athens University during the past 17 years. These fractures represent 14.2% of all cervical fractures treated at the department during the same period. There were 28 men and 21 women with a mean age of 44 years (range 14-78 years). Road traffic accidents were by far the most common cause of injury; 58% of the patients were victims of such an accident. Radiographs showed 26 anterior oblique fractures, 15 horizontal fractures, and eight posterior oblique ones. Twenty-eight of the patients sustained associated injuries, 19 of them to the spine. Neurological lesions were present in nine (18.3%) patients, but in seven cases the symptoms were due to a distal lesion; there was a Brown-Sequard syndrome and a quadriaparesis, both of which were attributed to the dens fracture.

All patients but one were treated conservatively; the exception was operated on 10 months following injury, because of the development of a pseudarthrosis. Conservative treatment consisted of skeletal or Glisson-type traction or, in two cases, of a simple collar.

Five patients died and three others were lost to follow-up, so 41 of 49 patients remained for analysis. The average follow-up period was 10 years (1-16 years).

Results

Conservative treatment led to excellent or satisfactory results in the majority of cases. The final results of
three died 1, 4, and 7 years after sustaining their injuries, apparently of causes unrelated to the fracture itself. Three patients have been without any mechanical support for 160, 68, and 33 months, respectively, complaining of stiffness and discomfort. None of these patients has a serious problem.

Discussion

Dens fracture is not an uncommon injury; an incidence of between 7% and 15% of all cervical fractures is reported [11, 14]. The classification of Roy-Camille et al. [10] into anterior oblique, horizontal, and posterior oblique fractures according to the direction of the fracture line has been followed in our series.

The rate of pseudarthrosis is reported to be between 2.4% and 82% for all types of dens fracture, and pseudarthrosis continues to complicate the management of this injury [3, 12]; its pathogenesis is attributed to many factors such as age, mode of accident, type of injury or fracture line, displacement, traction applied, and the stability obtained, as well as to when the proper treatment was started.

There is great deal of controversy between different authors as far as certain of these factors are concerned [4, 11], but we observe that nearly all these factors have a common denominator: the purely mechanical instability that has nothing to do with the blood supply to the dens, as has been shown [5, 11]. Table 1 shows our cases of pseudarthrosis and the different factors we examined. Pseudarthrosis is detected either on plain films or during dynamic radiographic examination, where the instability is more obvious (Fig. 3).

Sex and mode of accident were not related to pseudarthrosis in this series. The rate of road traffic accidents in the whole series was 58%, similar to that reported in the literature [3, 11, 14] and similar to that in the pseudarthrosis group. Sex, also, is equally distributed in both groups.

Age seems to play a role in favor of nonunion, and we agree with Roy-Camille's view that older people have a higher risk of developing pseudarthrosis [10]. In this series only two of the patients with pseudarthrosis were younger than 50 years, the mean age being 58.8 years (28–78), i.e., 14.8 years older than the group of patients in which union occurred.

A displacement of between 2 mm and 15 mm (mean displacement 3.9 mm) of the dens was present in 24 patients. This displacement was related to posterior oblique and horizontal fractures (Fig. 4a); three patients with a mean displacement of 10.4 mm developed nonunion. Blockey and Purser [4] found no significant correlation between displacement and outcome of this injury, but their view is not accepted by