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Epidemiologic Notes and Reports Toxic-Shock Syndrome -- United States

As part of its commemoration of CDC's 50th anniversary, MMWR is reprinting selected MMWR articles of historical interest to public health, accompanied by a current editorial note. Reprinted below is the first MMWR report of toxic-shock syndrome, which was published May 23, 1980.

Cases of a newly recognized illness known as toxic-shock syndrome (1) have recently been reported to CDC by state health departments in Wisconsin, Minnesota, Illinois, Utah, and Idaho. Physicians in 8 other states have reported individual cases to CDC or to investigators at the University of Colorado, Denver.

Toxic-shock syndrome typically begins suddenly with high fever, vomiting, and profuse watery diarrhea, sometimes accompanied by sore throat, headache, and myalgias. The disease progresses to hypotensive shock within 48 hours, and the patient develops a diffuse, macular, erythematous rash with non-purulent conjunctivitis. Urine output is often decreased, and patients may be disoriented or combative. The adult respiratory distress syndrome or cardiac dysfunction may also be seen.

Laboratory studies reveal elevated blood urea nitrogen, serum creatinine, bilirubin, and creatine phosphokinase levels, and white blood cell counts with marked left shifts. Platelet counts are low in the first week of illness but are usually high in the second week.

Patients require large volumes of fluid to maintain perfusion and usually require intensive care. In the recovery phase, there is desquamation of at least the palms, soles, or digits and often of other skin areas as well.

Since October 1, 1979, 55 cases have been reported to CDC. Fifty-two of these (95%) have been in women. The mean age is 24.8 years, with a range of 13-52 years. Seven deaths have occurred, for a case-fatality ratio of 13%.

Of 40 patients in whom a menstrual history was obtained, 38 (95%) had onset of illness with the 5-day period following onset of menses. Two others had onset of illness 10 days after onset of menses.

Moreover, 13 patients have had recurrence of symptoms with a subsequent menstrual period.

In 33 of 45 (73%) patients cultured, *Staphylococcus aureus* was isolated from the throat, cervix, vagina, or rectum. Four of 15 patients (27%) tested for Herpesvirus hominis had serologic or cultural evidence of herpes infection. No evidence for leptospirosis, Rocky Mountain spotted fever, viral exanthematous diseases, or streptococcal scarlet fever has been found in those patients in whom it has been looked for.

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editorial Note: Toxic-shock syndrome is a serious disease of unknown etiology. It affects primarily young women of child-bearing age who have been previously healthy, and it has a case-fatality ratio for reported cases of 10%-15%. This ratio is probably high because severe cases are easier to recognize. In Wisconsin, where surveillance has been very active, the case-fatality ratio has been 3.2%. The incidence of the disease is not known but is apparently low. The increasing number of reported cases over the past 6 months is probably due to increasing recognition. In support of this theory, a review of medical charts in Wisconsin for the past 2 years revealed 6 cases fitting the case description that had not previously been recognized as toxic-shock syndrome.

The syndrome resembles Kawasaki disease (mucocutaneous lymph node syndrome) in several respects, namely fever, rash with subsequent desquamation, and cardiac involvement. However, shock, which is prominent in toxic-shock syndrome, is not usually seen in Kawasaki disease. The character of the rash is also different in the 2 diseases: it is a maculopapular one in Kawasaki disease but a non-papular, diffuse erythroderma in toxic-shock syndrome. Azotemia and thrombocytopenia are rarely seen in Kawasaki disease and are common in toxic-shock syndrome. Kawasaki disease classically occurs in children less than 5 years of age; some recently reported cases of "adult Kawasaki disease" (2,3) may actually be cases of toxic-shock syndrome.

Toxic-shock syndrome was first recognized in 7 children aged 8-17 years, 3 of whom were boys (1). In 5 of the 7, *S. aureus* was isolated from the nasopharynx, vagina, or localized abscess. At that time it was hypothesized that the syndrome was caused by a toxin elaborated by the staphylococci. Although *S. aureus* was isolated from vaginal cultures in two-thirds of patients in the current report, no control study has been done to show that this prevalence is unusually high. The isolation of Herpesvirus in a small number of cases probably reflects stress-related recurrence of infection and not an etiologic role for the virus. CDC, in cooperation with a number of investigators, is setting up a nationwide case-control study to try to define the epidemiologic features and the cause of this disease. references

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Editorial Note

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Editorial Note 1997: Although case reports of "Staphylococcal scarlet fever" had been published in the medical literature as far back as the 1920s, a 1978 report describing seven cases of what was named toxic-shock syndrome (TSS) heralded the apparent emergence of TSS in late 1979 and early 1980 (1). The report about TSS in the May 23, 1980, *MMWR* and the veritable landslide of studies of TSS that followed demonstrate the speed and effectiveness with which astute clinicians -- together with public health officials, epidemiologists, and laboratory scientists -- can respond to an "emerging" infectious disease threat. Did TSS truly "emerge" at that time, or did the intensive case-finding efforts of clinicians and epidemiologists in states such as Wisconsin and Minnesota simply make it appear to "emerge"? The limited data available from retrospective chart-review studies that were designed to identify TSS cases, whether previously diagnosed or not, clearly demonstrated that the number of cases of TSS in women of reproductive age increased beginning in the late 1970s (2-4). Cases of TSS in men also occurred during that time but at a low and stable rate. Thus, what "emerged" during late 1979-early 1980 was not all TSS, but TSS in reproductive-aged women, particularly menstruating women, as reflected in the dramatic data presented in the *MMWR* report -- of the 55 reported cases, 95% occurred among women, and 95% of the cases among women for whom information was available had onset of their illness within the 5-day period following onset of menses. The startling proportion of TSS cases identified during 1979-1980 among women who had onset during menstruation led investigators to focus on understanding the risk factors for development of menstrual TSS, rather than TSS in general. The wave of rapidly completed case-control studies of menstrual TSS that followed clearly demonstrated that use of various brands and styles of tampons was by far the most important risk factor for TSS during menstruation (5-8). Although the relative importance of absorbency, chemical composition, and other tampon-related factors in determining the risk for menstrual TSS has remained difficult to determine, the most plausible explanation for the "emergence" of menstrual TSS in the late 1970s was the manufacture and widespread use of more absorbent tampons made of a variety of materials not previously used in tampons. There is no evidence to suggest that changes in *Staphylococcus aureus*, the source of the toxin that causes TSS, were responsible for the emergence of menstrual TSS.

The week after the *MMWR* report appeared in May 1980, Dr. William Foege, the director of CDC at the time, testified before the Senate Subcommittee on Health regarding "toxic dumps." Given the widespread news media attention the *MMWR* report had received and a perceived connection between toxic dumps and toxic-shock syndrome, Dr. Foege also was asked about TSS at that hearing, and he optimistically promised "an answer" by the end of 1980. Although much more was learned about TSS during the years that followed (e.g., the biologically important properties of TSS toxin-I, the toxin responsible for most cases of TSS, particularly menstrual cases), in retrospect Dr. Foege was correct. From the public health point of view, before the end of 1980, enough was known about menstrual TSS based primarily on observational epidemiologic studies to promulgate recommendations (9,10) that led

to a substantial reduction in the risk for menstrual TSS.

Perhaps less well known in the public health community is the important legal precedent that emerged from the civil litigation surrounding menstrual TSS. Faced with a large number of lawsuits filed by women with menstrual TSS, one of the tampon manufacturers filed suit to compel CDC to release the names and other personal identifiers of all women who had participated in the CDC case-control studies of menstrual TSS. Because the results of these studies (and hence the "collective evidence" of the study participants) were being introduced as evidence by women in their lawsuits against the manufacturer, the manufacturer argued that it had a fundamental legal right to know who these women were and even cross-examine them. Although the manufacturer had been given copies of all the data tapes and all the raw data forms from the studies (with identifiers removed) so its experts could reanalyze the results, the manufacturer also argued that it needed to re-interview the study participants several years after the case-control studies had been conducted to assess the extent to which bias had been introduced at the time of the original interviews (11). The federal appeals court decided that the manufacturer could not have access to the personal identifiers of the study participants. The court ruled that in furtherance of its mission to protect the public health, CDC must be able to "conduct probing scientific and social research supported by a population willing to submit to indepth questioning." The court further ruled that "disclosure of the names and addresses of research participants could seriously damage this voluntary reporting" and that "even without an express guarantee of confidentiality there is still an expectation, not unjustified, that when highly personal and potentially embarrassing information is given for the sake of medical research, it will remain private" (12). Thus, the series of events that unfolded following the publication of the MMWR report not only led to an expeditious public health response to the emergence of menstrual TSS but to enhanced legal protection at the federal level of the public health research process.

1997 Editorial Note by: Arthur L Reingold, MD, University of California, Berkeley. Gene W Matthews, JD, Legal Advisor to CDC. Claire V Broome, MD, Deputy Director, CDC.

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