Serogroup analysis of Meningococcal strains causing Septic Meningococcal Arthritis in England and Wales: A retrospective study

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INTRODUCTION

- Systemic meningococcal infection may present as septicaemia or meningitis or both, with life-threatening complications such as myocarditis, endocarditis, pericarditis, pneumonia, and septic meningococcal arthritis, as well as long-term effects like amputation, hearing loss and seizures.
- Septic meningococcal arthritis (SMA), a rare complication of IMD, has been found to manifest as primary, secondary, or tertiary meningococcal arthritis. Meningococcal arthritis can present as mono or polyarthritis and, in most cases, affect large joints such as the knee.
- Meningococci are classified into serogroups (A, B, C, E, H, I, K, L, W, X, Y, and Z), and subsequently into sequence type (ST) strains based on their antigenic polysaccharide capsule and chromosomal DNA sequencing of other regions, respectively.
- The main objective of this study is to describe cases of septic arthritis in England and Wales from samples received at the Meningococcal Reference Unit, Manchester over a ten-year period, and the use of culture and PCR techniques in the laboratory diagnosis of meningococcal arthritis.

METHODS

- Synovial fluid samples sent to the Meningococcal Reference Unit (MRU) in Manchester were confirmed for the presence of *N. meningitidis* either directly by *ctrA* real-time PCR test and/or following a positive culture result.
- Following a positive *ctrA* PCR, *siaD* and *mynB* PCR assays were performed to characterise isolates into serogroups B, C, Y and W, and serogroup A respectively.
- Culture positive *N. meningitidis* strains were serologically characterised into MenB, MenC, MenW, MenY and MenE serogroups.
- In many cases, corresponding blood samples were also tested. Septic meningococcal arthritis was defined as the detection of *N. meningitidis* in a joint fluid following a bacterial culture or PCR test.

Table 1. Joint fluid (JF) cases and sample sites

Sample Site	No. of cases
Ankle	13
Disc	1
Elbow	8
Hip	22
Knee	91
Shoulder	6
Unknown (JF)	9
Wrist	10
Total	**160**

RESULTS

In all 276 samples with requests for the detection of *N. meningitidis* were selected. For purpose of this study, 160 joint or synovial fluid samples (representing approximately 58% of cases) were selected for further analysis. *N. meningitidis* strains were detected by culture, PCR or both methods from 109, 37 and 14 joint fluid samples, respectively. More than half (56.9%) of the joint fluid samples were the knee (*n* = 91), followed by hip (36.7%), ankle (8.1%), wrist (5.6%), elbow (5%) and shoulder (3.1%). It is noteworthy to mention that MenA was not isolated from any of the joint fluid samples received at the MRU.

Table 2 below shows the distribution of meningococcal serogroups following laboratory diagnosis of SMA by culture and PCR assays. It also shows serogroup distribution with MenW commonly isolated by culture, PCR, or by both culture and PCR, and across both genders followed by MenB, MenC and MenY respectively.

Figure 1 shows that, SMA caused by MenW was the predominant strain in the 0 – 5, and > 20 years age groups, 35.5% and 32.3% respectively, followed by MenB in the 0 – 5 age group. In Figure 2, it can also be established that MenW was the most frequent (41.25%) serogroup followed by MenB (26.25%), MenY (20.63%), MenC (11.25%), and MenE (0.63%).

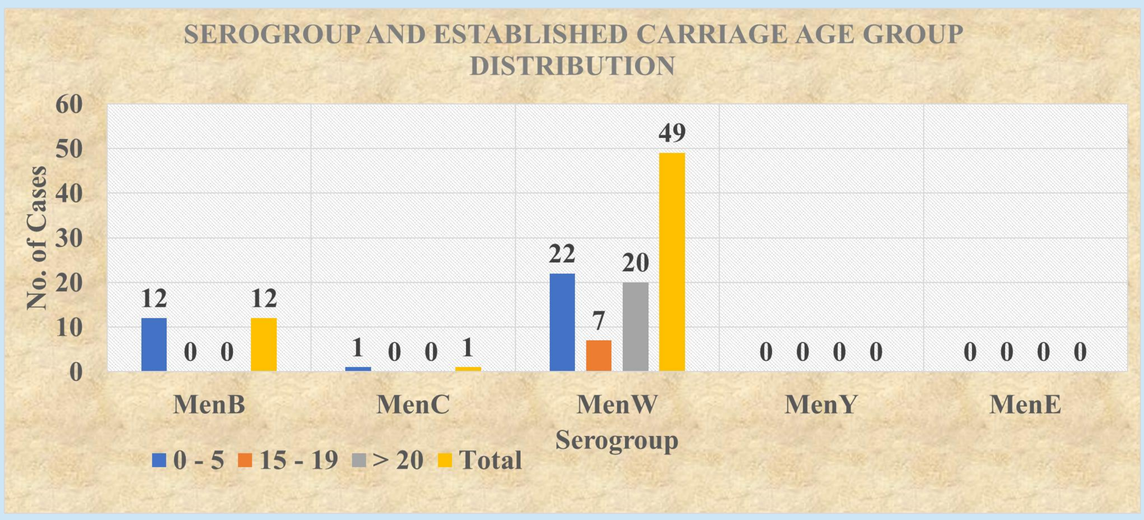

Figure. 1. Serogroup and carriage age distribution

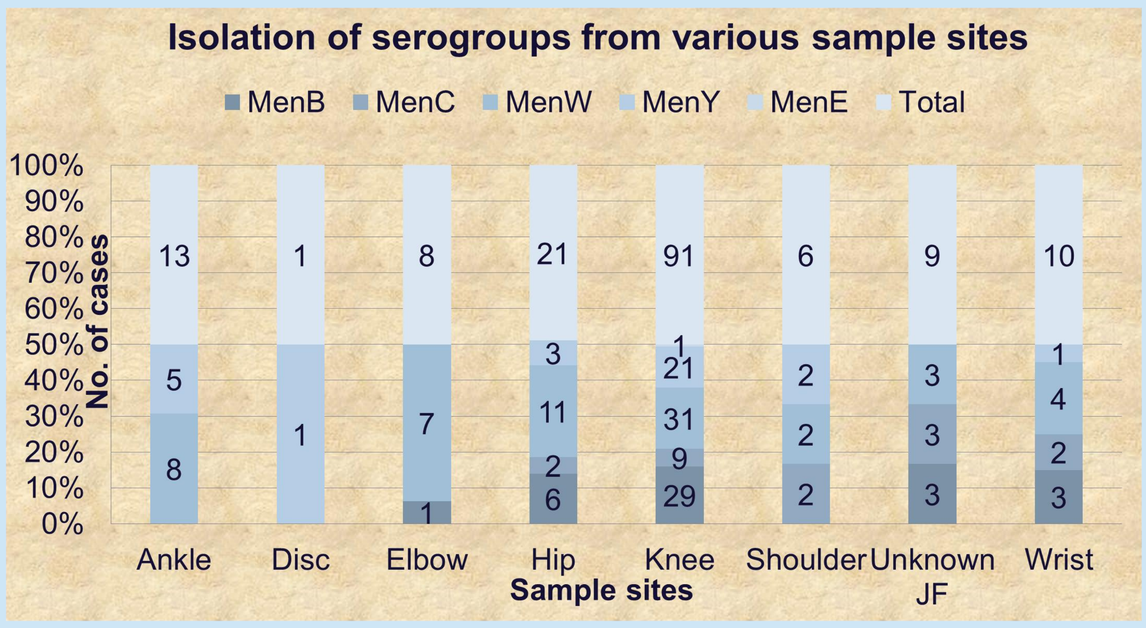

Figure. 2. Serogroups isolated from the various sample sites.

Table 2. Serogroup distribution in septic meningococcal arthritis

Serogroup	Gender			Pos. Culture	Pos. PCR	Pos. Culture and PCR	No. of cases
	M	F	GU*				
MenB	22	19	1	28	11	3	42
MenC	13	5		9	7	2	18
MenW	30	32	4	45	16	5	66
MenY	13	20		26	3	4	33
MenE	1	0		1	0	0	1
Total	**79**	**76**	**5**	**109**	**37**	**14**	**160**

*GU – Gender Unknown (details could not be found), Pos - Positive

DISCUSSION and CONCLUSIONS

- This study confirms the knee, as previously published elsewhere, as the joint predominantly involved in SMA, with MenW as the predominant serogroup (representing 41.25%). Due to the rarity of SMA, most published studies are based on a few case reports.
- This study includes a large number of SMA cases (*n* = 160) and can suggest that the prevalence of MenW confirmed from SMA samples received at the MRU over the last ten years may be associated with clonal ST 11 clonal complex.
- Preliminary analysis of the current sequence data shows that high proportion of the MenW strains isolated from the various synovial fluid samples belong to the ST 11 – clonal complex, which is associated with case fatalities among all age groups, especially in children less than 5 years. The predominance of MenW among children with SMA as established in this study confirms previous findings and predictions[1,2,3].
- Due to insufficient clinical details for most of the clinical cases recruited in this study, it was not possible to fully analyse all cases such as classify septic arthritis into the various types, characterise polyarticular arthritis (though some samples were collected from multiple sites), and determine case-fatality rates among the various age groups analysed.
- Though gender-based distribution of serogroups was considered in the current study, as there was a few more cases in males than in females, the findings however cannot directly be linked with the predominance of MenW in SMA cases as compared to other serogroups.
- However, a future study could consider the interplay of gender and established environmental, and host behavioural risk factors such as smoking and how they influence meningococcal carriage in a population.

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