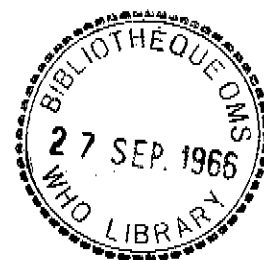


ABO BLOOD GROUPS AND SMALLPOX IN A RURAL POPULATION
OF WEST BENGAL (INDIA)¹

by

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Some years ago, the hypothesis was discussed that the ABO distribution of the world population might be influenced by differential susceptibility to some infectious diseases. In this connexion, a more severe course and higher mortality of smallpox in groups A and AB as compared with B and O was postulated on serological grounds (Vogel, Pettenkofer & Helmbold, 1960). Meanwhile, limited, but conflicting evidence has been published and a fresh attack to the problem by examination of smallpox patients seemed to be urgently needed.

The examination had to be carried out under natural conditions, i.e. in patients, who were staying at home and did not have modern medical care. Sampling of patients in big infectious diseases hospitals is influenced by uncontrolled biases, and therapy might influence the outcome of the disease.

The field work was carried out during the summer of 1965 by Chakravartti in the Burdwan district, West Bengal, and during spring 1966 by Vogel and Chakravartti in some districts of West Bengal and Bihar. Information as to smallpox attacks was

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collected from the local health authorities. The affected patients were visited in their homes, blood samples were taken, and the patients classified according to a four-degree scale with regard to severity of the attack (mild, severe, very severe, haemorrhagic). An effort was made to examine all patients in the affected villages and towns. The blood group determinations were carried out on the same day using Anti-A, Anti-B and Anti-AB sera in 1965, and additionally, Anti-A₁ and Anti-H sera in 1966. Some weeks later, all places were visited again in order to find out whether the patients had survived their attack.

The material now available consists of the following four series:

1. Two hundred fresh unvaccinated cases examined in 1965. For each of these cases, one healthy sibling was examined as a control.
2. Two hundred and thirty-seven fresh cases examined during spring 1966. Of these patients, 22 had been vaccinated before, the others were unvaccinated. Two hundred and twenty-eight unaffected siblings were used as controls. Statistical evaluation was carried out using Woolf's method.

Table 1 shows blood groups and relative incidences of patients as compared with the controls. The relationship with group A and AB ($x = 6.09$) is very strong and highly significant ($\chi^2 = 128.92$ with 1 degree of freedom). Table 2 shows severe as compared to mild attacks in the same two series. Again, there is a very strong and highly significant deviation in the direction expected: A and AB have more severe attacks ($x = 3.154$; $\chi^2 = 36.27$).

In Table 3, mortality is examined. In both series (over-all) mortality is very high, indeed (48.05 per cent.). Relative incidence of a fatal outcome is $x = 3.975$ in patients of groups A and AB as compared to groups B and O ($\chi^2 = 38.66$).

3. Series No. 3 contains patients which had suffered from smallpox during 1964, but survived, and were examined during summer 1965. Classification was done from their smallpox scars. These patients came from the same area as series No. 1. During the 1964 epidemic, 749 attacks were registered and 347 (46.3 per cent.) of the patients died. The 402 surviving patients could all be examined. Three hundred and fifty siblings were taken as controls.

4. Series No. 4 contains 146 surviving cases of the 1966 epidemic which were examined on the occasion of the fresh cases survey (series No. 2). No effort was made as to completeness and no controls were examined.

Table 4 shows a comparison of fresh and survived cases (series 1 and 3, and series 2 and 4) in the same areas. A strong prevalence of A and AB in fresh cases emerges, indicating again a higher mortality of A and AB ($x = 2.892$; $\chi^2 = 59.16$).

In Table 5, severity of the disease as shown by the extent of scarring is compared. Again there is a strong and significant deviation in the direction expected. If series No. 3 (survived cases) is compared with 350 healthy controls, on the other hand, groups B and O are more frequent among the survivors, obviously due also to a higher mortality of groups A and AB.

In conclusion, our examination of 985 smallpox patients and 778 controls shows a very strong disadvantage of persons with groups A and AB as compared with groups B and O. This disadvantage consists of a much higher risk of becoming affected with smallpox, a much more severe type of the disease, and a much higher mortality. All these differences are strong and fully significant statistically. The whole topic will be discussed more fully in the near future.

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Table 1

Frequency (patients-controls)

Series		blood-group				X A+AB: B+O	χ^2	P
		A	B	O	AB			
1965	P=200	106	48	37	9	4.059	41.642	
	K=200	38	66	84	12			
1966	P=237	110	53	29	45	9.758	94.844	
	K=228	25	108	83	12			
	P=437 K=428					combined comparism 6.09	combined χ^2 136.86	
						X ² of deviation	128.92	

WHO 61037

Table 2

Severeness of the disease among 437 fresh smallpox cases and ABO blood groups

blood group	1965 series			1966 series		
	T-1 mild	T-2 severe	T-3 very severe	T-1 mild	T-2 severe	T-3 very severe
A	40	58	8	16	63	31
B	30	17	1	20	27	6
O	23	14	-	2	20	7
AB	2	5	2	4	21	20

WHO 61038

 $T_1 + T_2$ vs T_3

Comparison	1965	1966	1965 + 1966
X (A+AB) : (B+O)	4.653	2.475	3.597
χ^2 of deviation (DF=1)	28.695	6.872	33.5901
χ^2 of heterogeneity (DF=1)			1.977

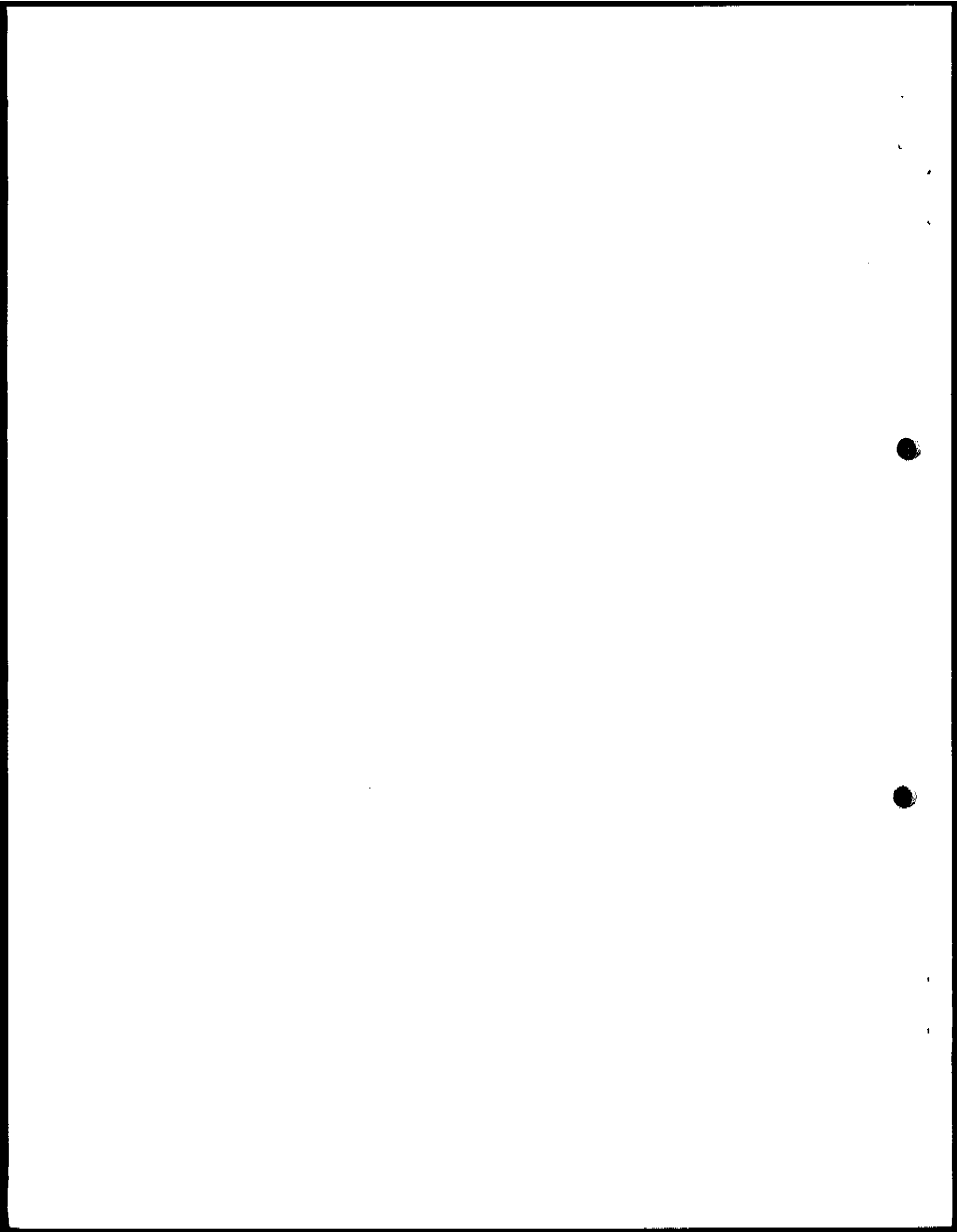


Table 3

Mortality

		blood group				X (A+AB):(B+O)	X ²	P
		A	B	O	AB			
1965	died 103	63	18	15	7	<u>2.451</u>	<u>9.343</u>	
	survived 97	43	30	22	2			
1966	died 107	67	10	4	26	<u>7.286</u>	<u>34.899</u>	
	survived 130	43	43	25	19			
sum	died: 210 (48.05%) survived: 227 (51.95%)					X 3.975		

X² of deviation: 38.655

X² of heterogeneity: 5.587

WHO 61039

Table 4

Survived cases, comparison with fresh cases of the same areas

series		blood group				X	X ² (DF = 1)
		A	B	O	AB		
1964	P 402	113	169	102	18	fresh cases against survived cases (A+AB):(B+O) <u>2.799</u>	33.33
	K 350	131	111	88	20		
1966	P 146	41	56	34	15	fresh cases against survived cases (A+AB):(B+O) <u>3.037</u>	25.91

TOTAL: 59.24

WHO 61040

X	2.892
X ² (DF = 1)	<u>59.158</u>
X ² (Het; DF = 1)	0.082

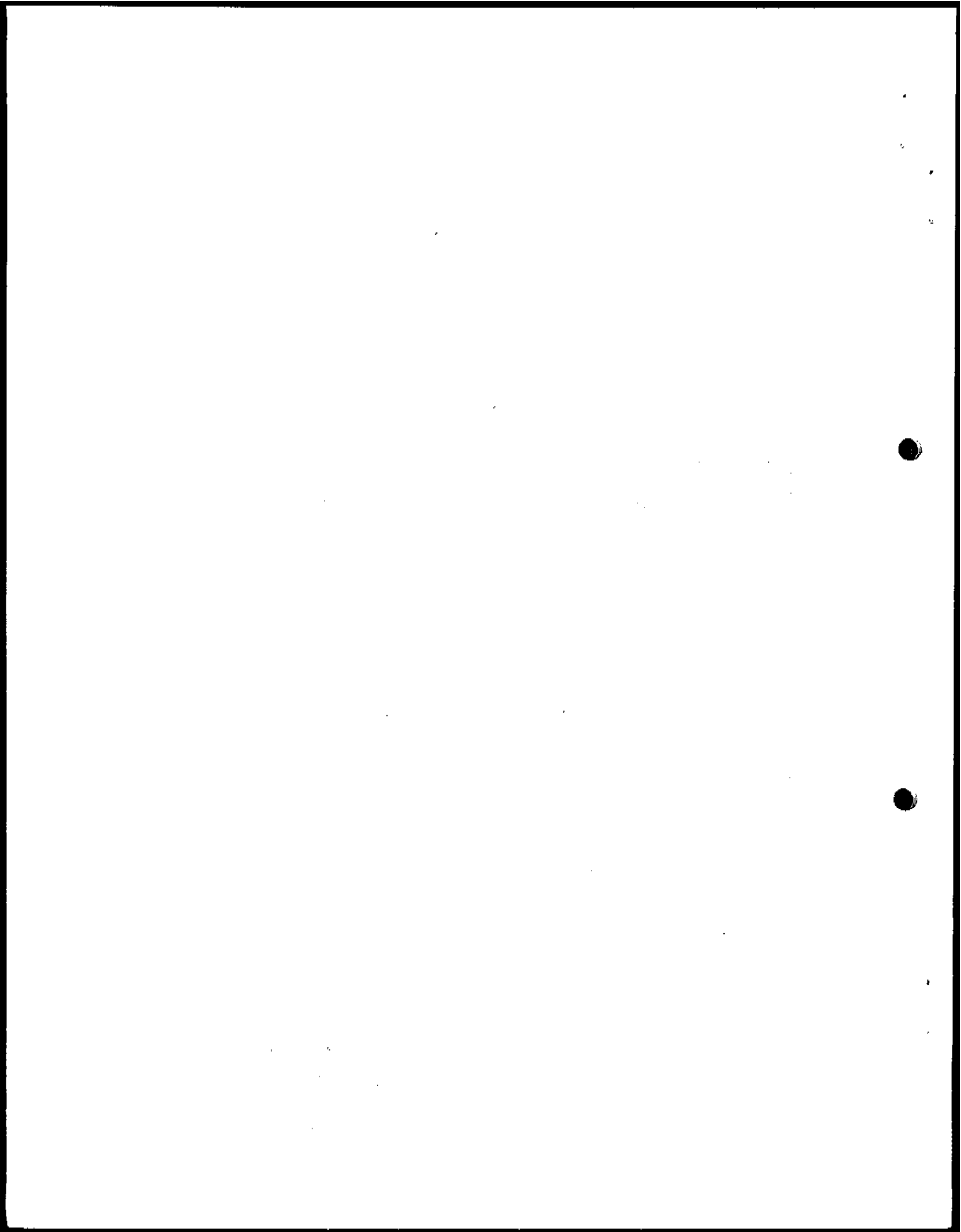


Table 5 *Severeness of the disease; survived cases*

blood group	1964 series			1966 series		
	<i>T - 1 mild</i>	<i>T - 2 severe</i>	<i>T - 3 very severe</i>	<i>T - 1 mild</i>	<i>T - 2 severe</i>	<i>T - 3 very severe</i>
A	34	79	-	15	26	-
B	101	68	-	26	22	7
O	74	28	-	18	14	2
AB	6	12	-	6	7	3

Comparism	<i>T₂ + T₃ vs T₁</i>		
	1964	1966	1964 + 1966
$X(A+AB) : (B+O)$	4.147	1.676	3.154
χ^2 of deviation (DF = 1)	38.813	2.216	36.274
χ^2 of heterogeneity (DF = 1)			4.755