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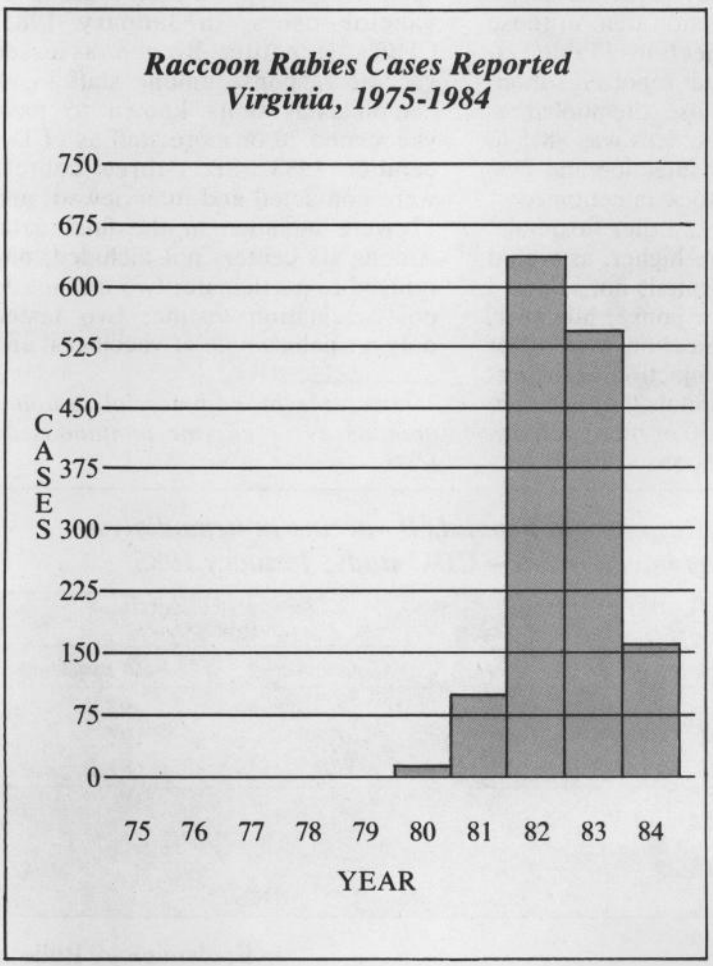
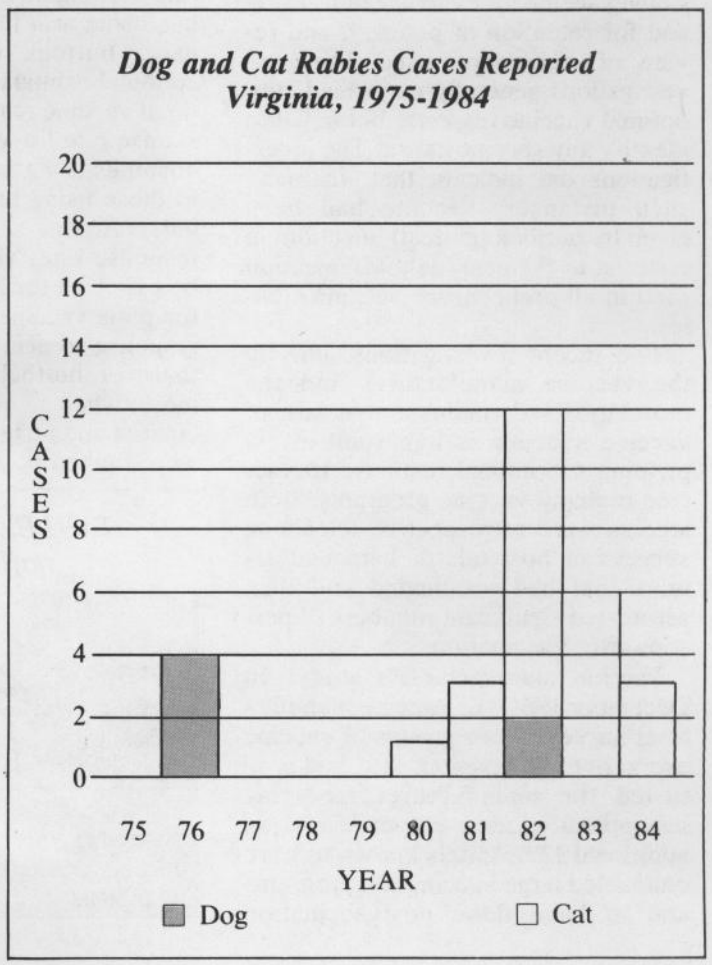
Reports of Raccoon Rabies Declining

A substantial decrease in the number of rabid raccoons being reported in Virginia has occurred (see Figure). Apparently the epizootic that was so intense in Northern Virginia has leveled off to an enzootic state. This probably reflects a decrease in susceptible raccoons caused by the large number that were killed by the disease and an unknown number who may have developed natural immunity. It is not clear whether the number of rabies cases will increase when the susceptible raccoon population recovers to pre-epizootic levels. Three counties reported raccoon rabies for the first time in 1984: Albemarle, Fluvanna and Louisa. Hanover county reported a rabid fox in 1984 and, in the last week of February, 1985, a rabid raccoon was reported from that county. The newly affected areas are much more rural than those previously reporting high numbers of positive raccoons. If the epizootic spreads south, as expected, more urbanized areas will be affected and there may be, once again, an upsurge in total numbers due to relatively dense populations of both raccoons and humans, as well as more pets to interact with the wildlife.

As shown in the figure, the incidence of cat rabies appears to have paralleled that of raccoons. At least 23 jurisdictions now have ordinances requiring rabies vaccinations for cats.





Injection into the Buttock

Suboptimal Response to Hepatitis B Vaccine

Hepatitis B (HB) vaccine was licensed in November 1981 as a highly immunogenic and effective vaccine against hepatitis B virus (HBV) infection. Large studies before licensure demonstrated, with one exception, that the vaccine induced antibody* in over 90% of healthy adult recipients of the three-dose series (*1-3*). The one exception, in which only 85% of recipients responded to vaccination, was later shown to be caused by partial freezing of the vaccine during shipment (*4*).

Since vaccine licensure, however, the vaccine manufacturer (Merck, Sharp & Dohme) and CDC have received reports of suboptimal response to vaccine in the health-care personnel of a number of hospitals and other vaccine users. Two such examples, in which only 82% and 68% of normal adults responded to vaccination, have recently been published (*5-6*). Initial investigations of these and other reports by the manufacturer and by CDC included site visits, repeat serologic testing of vaccine recipients to confirm poor response, assays of residual vaccine for evidence of freezing and for retention of potency, and review of vaccine lots used. These investigations generally confirmed suboptimal vaccine response but failed to identify any specific cause. The investigations did indicate that, in many such instances, vaccine had been given by buttock (gluteal) injection, in contrast to the arm (deltoid) injection used in all prelicensure vaccine studies.

Two recent investigations, one by the vaccine manufacturer and the other by CDC, indicate that site of vaccine injection is important in explaining suboptimal response to vaccine in many vaccine programs. Both studies were retrospective telephone surveys of hospitals or hemodialysis units that had vaccinated and then serotested significant numbers of persons after vaccination.

Vaccine manufacturer's study: In December 1984, the vaccine manufacturer surveyed two groups of vaccine users: over 90 hospitals that had contacted the manufacturer reporting suboptimal vaccine response and an additional 12 hospitals known to have conducted large vaccination programs and to have done postvaccination testing. The telephone survey verified the exact number of persons completing vaccination and the number failing to respond to vaccine and determined the vaccine injection site. Injection site for the hospital was classified as arm if over 90% of persons received vaccine in the arm; buttock if over 90% received vaccine in the buttock; and mixed for all others.

In both surveys, vaccine response rate was significantly higher in hospitals using arm injection than in those using buttock injection (Table 2). Among hospitals that reported suboptimal vaccine response, the pooled response rate for vaccinees was 88% in hospitals using arm injection and 73% in those using buttock injection ($p < 0.01$). Among the 12 other hospitals, response rates were higher, as would be expected for hospitals not selected for poor vaccine response; however, response to arm injection was higher than for buttock injection. Furthermore, when 55 hospitals that had vaccinated and tested 50 or more persons were ranked by response rate to vaccine and compared, arm injection was clearly superior (Figure 1). Among 18 institutions reporting 90% or better response, 13 used arm injection, and one used buttock. Among 21 reporting lower than 80% response, 18 used buttock injection, and two used arm injection.

CDC's study: To avoid selection bias inherent in the above study and to more accurately assess vaccine response in a representative group of vaccine users, in January 1985, CDC's Hepatitis Branch assessed vaccine response among staff in all hemodialysis units known to have vaccinated 20 or more staff as of December 1983. Sixty-three centers were contacted and interviewed, and 57 were included in the final data. Among six centers not included, one refused to participate; two did not do postvaccination testing; two tested only a small sample of vaccinees; and

TABLE 1. Vaccine response in hospitals reporting suboptimal and normal response to HBV vaccine, by injection site—Merck, Sharp & Dohme study, December 1984

Group	Injection site	Reported seroconversion rate: No. tested	Reported seroconversion rate: % with antibody	p value*
Suboptimal response†	Arm	1,780	88	< 0.01
	Mixed	764	85	
	Buttock	4,786	73	
Normal response§	Arm	2,058	96	< 0.05
	Mixed	307	94	
	Buttock	81	90	

*Arm, compared with buttock. †Ninety-three institutions. §Twelve institutions.

*Detectable by commercial radioimmunoassay or enzyme immunoassay tests.

TABLE 2. Response to hepatitis B vaccine in hemodialysis staff, by injection site—CDC study, January 1985

Injection site	No. centers	Average response (%): Mean	Average response (%): S.D.	Total seroconversion rate in vaccinees: No. vaccinated	Total seroconversion rate in vaccinees: % with antibody
Arm	20	93.0	±7.3	733	93.9
Mixed	14	89.1	±8.7	478	91.2
Buttock	23	81.9	±12.1	664	81.0
Buttock, compared with arm		$p < 0.01$		$p < 0.001$	
Mixed, compared with arm		NS		NS	

one had participated in a prelicensure vaccine trial. In addition to the questions in the first survey, centers were asked to identify the laboratory method of postvaccination testing, length of needle used for injection, and proportions of vaccinees who were over 40 years of age or who were significantly overweight. Among the 57 centers, 20 used arm injection (as defined above); 23 used buttock injection; and 14 used mixed sites of injection.

Antibody response was significantly higher in centers using the arm as the injection site (Table 3). The average vaccine response in such centers was 93%, compared with 82% response in sites using buttock injection ($p < 0.01$). This difference remained highly significant when the method of postvaccination testing and the proportions of vaccinees who were over 40 years old or overweight were considered in the analysis. Despite overall poorer response with buttock injection, response in individual centers varied widely (Figure 1). Among centers using buttock injection, eight (35%) reported excellent response to vaccine (over 90% responding), and nine (39%) reported poor response rates (fewer than 80% responding). In contrast, 75% of centers using arm injection reported excellent response, and only one (5%) reported poor response. Seventeen centers using the buttock as injection site reported using 1½-inch needles, while the other six used 1-inch needles. There was no difference in response rates among these two groups.

Editorial Note: Although these studies are preliminary, they strongly suggest that response to HB vaccine is higher when vaccine is given in the arm than in the buttock. Furthermore, they appear to provide an explanation for poor rates of response to HB vaccine reported in some vaccine programs. These data are the first to indicate that response to any inactivated vaccine given intramuscularly to adults may vary with injection site. The Immunization Practices Advisory Committee (ACIP) has previously recommended that the arm is the preferred site of injection for all adult vaccines (7). However, the present studies demonstrate that the buttock is a commonly used site for HB vaccination. Because of the important implications for use of HB vaccine and other killed vaccines, a prospective study has been initiated to confirm these data.

The physiologic reasons for lower response rate to vaccine injections in the buttock are yet to be defined. The most likely explanation is that injections given in the buttock frequently fail to reach muscle and are instead deposited in fat where the vaccine may not be well mobilized. The authors of a recent study using CAT scans to assess gluteal fat thickness estimated that, when adults are given injections in the buttock using a 3.5 cm (1⅜-inch) needle, 85% of injections in men and 95% of those in women are deposited in fat rather than muscle (*8*). An earlier study showed that lidocaine is mobilized more slowly when injected in the buttock than when given in the arm (*9*).

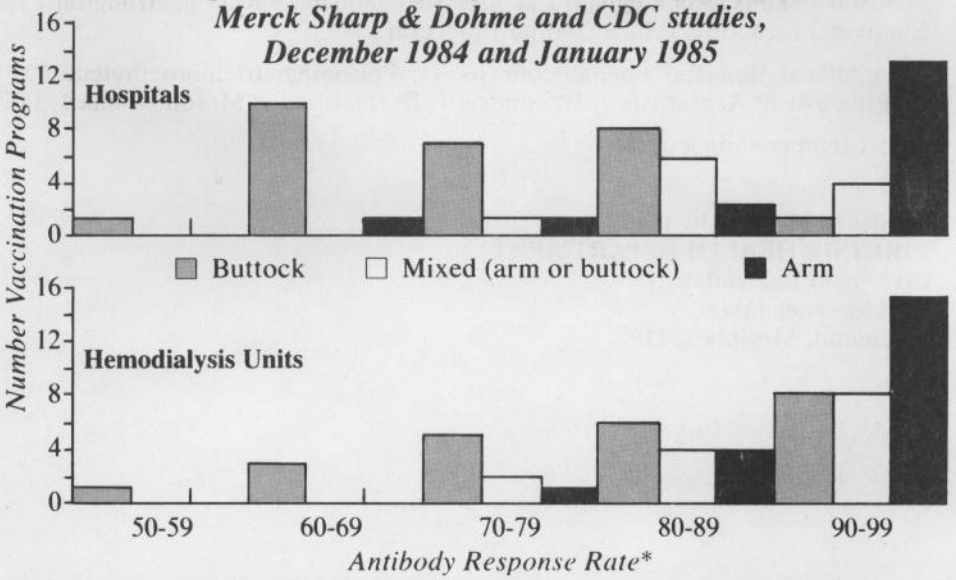
Pending further data, the ACIP and CDC recommend that the arm be used as the site of HB vaccine administration in all adults. For hemodialysis patients, who do not respond as well to vaccine as immunocompetent individuals, vaccine should be given in the arm unless this will jeopardize shunt access. For infants born to HBV-carrier mothers, the preferred site for HB vaccination remains the anterolateral thigh.

References

1. Krugman S. Holley HP Jr, Davidson M, Simberkoff MS, Matsaniotis N. Immunogenic effect of inactivated hepatitis B vaccine: comparison of 20 microgram and 40 microgram doses. J Med Virol 1981;8:119-21.
2. Szmuness W, Stevens CE, Harley EJ, et al. Hepatitis B vaccine: demonstration of efficacy in a controlled clinical trial in a high-risk population in the United States. N Engl J Med 1980;303:833-41.
3. Francis DP, Hadler SC, Thompson SE, et al. The prevention of hepatitis B with vaccine. Report of the Centers for Disease Control multicenter efficacy trial among homosexual men. Ann Intern Med 1982:97:362-6.
4. McLean AA, Shaw R Jr. Hepatitis B vaccine [Letter]. Ann Intern Med 1982;97:451.
5. Strickler AC, Kibsey PC, Vellend H. Seroconversion rates with hepatitis B vaccine [Letter]. Ann Intern Med 1984;101:564.
6. Schaaff DM, Lender M, Snedeker P, Graham LA. Hepatitis B vaccine in a hospital. Ann Intern Med 1984;101:720-1.
7. CDC. General recommendations on immunization. MMWR 1983;32:1-16.
8. Cockshott WP, Thompson GT, Howlett LJ, Seeley ET. Intramuscular or intralipomatous injections? N Engl J Med 1982;307:356-8.
9. Cohen LS, Rosenthal JE, Horner DW Jr, et al. Plasma levels of lidocaine after intramuscular administration. Am J Cardiol 1972;29:520-3.

Reprinted from MMWR 1985;34:105-8, 113.

FIGURE 1. Response rates to hepatitis B vaccine in hospitals and hemodialysis units, by injection site— Merck Sharp & Dohme and CDC studies, December 1984 and January 1985



*Percentage of vaccinated persons in each program who developed antibody after vaccination. Antibody was detected by commercial radioimmunoassay or enzyme immunoassay tests.

Month: April, 1985

Disease	State					Regions				
	This Month	Last Month	Total to Date 1985	Total to Date 1984	Mean 5 Year To Date	This Month N.W.	N.	S.W.	C.	E.
Measles	5	7	12	2	48	0	0	5	0	0
Mumps	5	5	16	7	30	0	1	1	1	2
Pertussis	1	1	3	7	8	0	0	0	0	1
Rubella	0	0	0	0	5	0	0	0	0	0
Meningitis—Aseptic	11	17	60	40	34	2	1	2	6	0
*Bacterial	25	28	111	101	87	4	2	10	4	5
Hepatitis A (Infectious)	21	9	81	37	64	1	6	14	0	0
B (Serum)	43	41	196	169	169	6	19	11	4	3
Non-A, Non-B	9	10	35	40	24	1	1	3	2	2
Salmonellosis	76	154	367	277	284	15	17	13	11	20
Shigellosis	6	7	23	102	139	3	3	0	0	0
Campylobacter Infections	36	52	147	132	67	9	6	8	9	4
Tuberculosis	36	32	105	131	—	—	—	—	—	—
Syphilis (Primary & Secondary)	25	36	111	143	192	1	2	6	3	13
Gonorrhea	1296	1897	5867	6362	6383	—	—	—	—	—
Rocky Mountain Spotted Fever	0	0	0	2	1	0	0	0	0	0
Rabies in Animals	19	24	64	99	104	10	2	3	4	0
Meningococcal Infections	9	12	33	31	31	0	1	4	3	2
Influenza	105	485	895	941	1488	25	6	56	17	1
Toxic Shock Syndrome	0	0	0	4	2	0	0	0	0	0
Reyes Syndrome	0	0	2	4	7	0	0	0	0	0
Legionellosis	1	2	5	5	5	0	0	0	1	0
Kawasaki's Disease	2	0	15	3	8	0	1	0	0	1
Other:										

Counties Reporting Animal Rabies: Albemarle 1 skunk; Augusta 1 raccoon; Fauquier 1 raccoon; Louisa 4 raccoons; Madison 1 skunk; Rockingham 1 skunk; Shenandoah 1 raccoon; Arlington 1 raccoon; Loudoun 1 raccoon; Lee 3 skunks; Hanover 3 raccoons; Prince George 1 raccoon.

Occupational Illnesses: Pneumoconiosis 34; Poisoning, trichloroethylene 35; Carpal tunnel syndrome 27; Silicosis 13; Hearing loss 8; Asbestosis 7; Byssinosis 1; Dermatoses 1; Mesothelioma 1; Poisoning, lead 1

*other than meningococcal

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